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THE NORTHWESTERN ELECTRICAL ASSOCIATION.

The meeting of the Northwestern Electrical Association, which was held last week at Milwaukee was in many respects one of the most interesting and successful in the history of the vigorous and flourishing organization. The programme was remarkable for its excellence and the high quality of the papers presented, most of which are printed in full or abstracted in this issue. A considerable increase in the membership of the association points to a growth of interest in electrical matters in the Northwestern States which is very gratifying.

ELECTRIC LIGHTING FOR PROFIT.

Profits are increased, as a general rule, whenever it is possible to diminish the cost of the thing sold, increase the price at which it is sold, or increase the amount of it sold. These considerations apply as well to electric current as to any other article of commerce, the only difference being that certain further considerations are also applicable in the case of electricity. The paper by Mr. Alexander Dow, which appears in another column, discusses the subject of the profitable conduct of the business of electricity supply in a way which is not only interesting, but so valuable that it should be seriously studied by all electric light men.

The principal factors in the profitable operation of central stations for lighting are, according to Mr. Dow, the system of rates and charges for current, and the use of a homogeneous system for the general distribution of the two varieties of light and power. Indeed the author so insists upon the importance of the latter condition that he regards it as no less than criminal to longer install plants with one set of machines for arc lighting, one for incandescent lighting, and perhaps another for power distribution purposes. Only in the case of supplying power to a railway does Mr. Dow advocate the installation of separate generating units, on account of the present impracticability of furnishing this variety of current from a general supply system.

The Wright demand meter system, or such a modification of it as would be found to best suit American conditions, is recommended as the best method for the adjustment of rates and charges. Consumers to whom it is explained are generally found to favor its use, and to be as nearly satisfied with their bills as customers ever are with bills. A satisfied consumer, according to Mr. Dow, is what the station manager should endeavor to make of each patron of his lines, and to this end much work outside the strict province of electricity supply can be profitably undertaken by the lighting station in order to keep its customers satisfied. By this means a customer once obtained is kept.

In order to satisfactorily adjust the rates of charge for current it is necessary for the manager to know just what is the amount of the "standing charges" upon his plant, or the amount it would cost to keep the plant in condition to supply its normal load, if every lamp were turned off. Into this enter all items of interest, depreciation, taxes, etc., as well as a large part of the salary and wages accounts, and coal enough to keep the machinery turning over on no load. All items beyond these are due to the load on the station. It is by a careful consideration of these standing charges and their relation to the total of operating expenses that economies may be foreseen,

rates made such that the income from lighting will be increased, and the operation of the plant brought to that point of operative efficiency indicated by regular and substantial dividends.

ALTERNATING CURRENTS IN TELEGRAPHY.

A remarkable series of experiments has been carried on by Messrs. A. C. Crehore and G. O. Squier on the telegraph lines of the British postal system. These experiments consisted mainly in comparisons of the transmitter devised for the synchronograph system and the Wheatstone transmitter, both being used on the same lines and with identical receivers of the Wheatstone type. The chief difference between the two types of transmitters is that the synchronograph transmitter uses as nearly as possible a sinusoidal alternating curve of impressed E. M. F., while the Wheatstone transmitter uses direct current and contacts which give a square cornered wave form. The results, as described in another column, show that, wherever the damping effect of the line kept the speed below the mechanical limit of the receiving instrument, the alternating transmitter invariably gave better results than the direct current, extreme instances being a triple multiplication of the possible speed. A probable explanation of this, as indicated by the authors, is the fact that many of the upper partials of the fundamental of the square cornered wave, of which there is an infinite series, are tuned to resonance with some part of the distributed capacity and self-induction, thus giving a complicated series of superposed oscillations on the circuit. As pointed out by a well-known engineer, a telegraph line is virtually a power transmission plant on a small scale, and it appears as though the sinusoidal current was to displace its rival, the direct current, here as in other fields.

The synchronograph transmitter sends a series of sinusoidal waves, signals being distinguished by the omission of one-half of the wave either below or above the line of no current. In this way the E. M. F. wave is abruptly broken off when it reaches the zero line, and abruptly started again later, giving sharp corners at these points. The assumption is made that the line, so to speak, falls in step, and takes a full current wave with the first impressed E. M. F. wave, which is not the case when self-induction and capacity are present. Electrical nature abhors a square corner and the line disturbances do not abruptly cease with the opening of the circuit on the instant of zero E. M. F. It might be better to distinguish the signals by bridging over the E. M. F. from peak to peak of the wave curve, thus giving an impressed voltage which the line could more nearly follow than the sharp cornered wave form used in the synchronograph system.

THE RELATIVE IMPORTANCE OF CENTRAL STATION LOSSES.

In the generation of electricity, and particularly in the generation of light from electricity, which will be specially considered here, there are losses in every step of the transformation process from the latent chemical energy of the fuel to the light emitted from the electric lamps. These losses are many of them elusive and very difficult of determination, but it is important from a financial standpoint that they be carefully studied, and their relative magnitude and importance determined, as well as the expense of their reduction, so that an intelligent answer can be given to the question: "Will it pay better to effect a saving here or there or at some other point?" Some of these losses in their order are the poor combustion, due to unavoidable causes and unskillful firing, the heat carried off by the flue gases, the escape of steam and condensation, the leakage of steam through valves and past piston rings, main engine friction, belt slip, dynamo losses, etc.

The consideration intended to be emphasized here is the fact that the losses are much more serious at the lamp end of the line than at the boiler end. The loss of heat by the stack represents simply a waste of coal and firemen's wages. The loss in condensation involves besides these, the necessary increase of boiler capacity to supply it. Similarly, the dynamo losses involve, in addition to these factors mentioned, the increased size of engines and the cost of engine attendance necessary to keep them in order; or, what amounts to the same thing on the average, without these losses the same boilers, engines and attendance could carry a greater load. In the same way, the line loss involves greater generators, and transformer losses greater lines. Finally, the losses due to inefficiency in the lamps involve increased boilers, engines, dynamos, lines and transforming devices, as well as attendance, and further increase the losses in all parts of the system in which the losses increase with the load.

This recital may sound a great deal like the nursery tale of "The House that Jack Built," but it leads to the conclusion that any percentage loss in the lamps is far more serious than the same percentage loss in the boiler room, the importance at intermediate points depending on their relative positions in the chain. A rough idea of the relative advantage of a given percentage saving in the lamps and in the boiler room may be obtained by comparing the total operating expense and fixed charges of the system, exclusive of the management and office expenses, with the cost of fuel. If this ratio is taken for the purposes of illustration at 6 to 1, it means that a 10 per cent. saving at the lamps is six times as great a saving as a 10 per cent. saving in the furnaces.

A rough idea of the distribution of the losses is obtained in modern stations by comparisons of the amount of coal burned with the switchboard output. This gives indications of the aggregate losses between the furnace and the switchboard, but no information of the distribution of the losses. Water meters in the boiler feed pipes would show whether any fault was due to the boilers or the engines, and an occasional application of the indicator to the latter would show whether the dynamo was to blame. These refinements are rather costly in small stations, but well worthy of careful application in large plants.

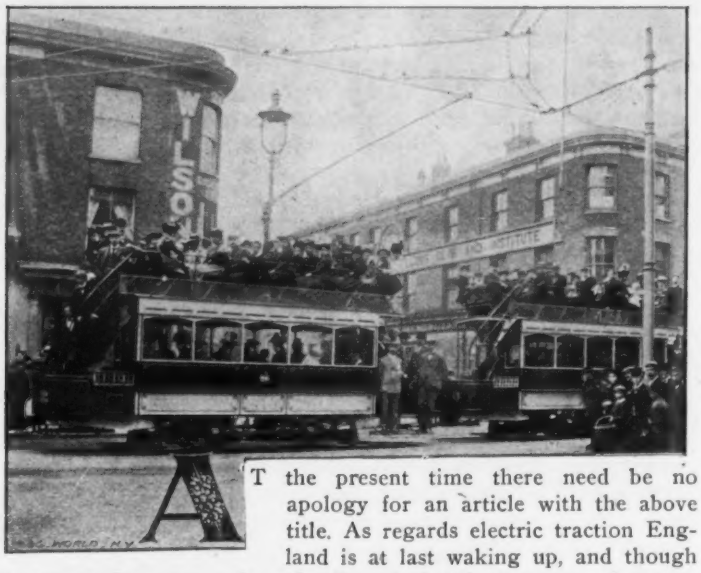
A MUNICIPAL PLANT.

The tremendous waste of power and materials involved in ordinary municipal operations for the disposition of sewage, the pumping and distribution of water, etc., and the possibility of turning the wasted materials to good account for fuel and thus to provide the energy necessary for the legitimate services of a municipality, form the theme of the excellent paper by Prof. R. B. Owens which appears in another column. It is not a new idea, of course, to suggest the use of town wastes for fuel, since this has been very effectively done abroad for some years, and the process has met with much favor, but the details of the application of such a method to the conditions existing in many American towns must necessarily differ considerably from those found satisfactory in England and Germany. Professor Owens calls attention to the vital importance of a homogeneous distribution system, and shows how the expensive and wasteful methods generally in vogue can be profitably supplanted by an electrical system operated from a single station, where garbage and other waste materials are burned under the boilers.

In towns where there is no natural head of water and pumping is necessary, as is the case over thousands of miles of country in the comparatively flat Western States, the usual form of water raising machine is the direct-acting steam pump. To replace this with an electrically driven power pump would mean in most cases a saving of from half to two-thirds the fuel required for its operation. To use the town's refuse for the fuel is the next step, and to divert part of the current for sewage purification the natural result of the establishment of such a plant.

Recent Electrical Tramway Construction in England—I.

BY HAROLD LOMAS.



AT the present time there need be no apology for an article with the above title. As regards electric traction England is at last waking up, and though at present there are only 136 miles of electric tramways, it seems safe to predict an enormous development in the near future. The reason for the apparent inertness is not far to seek; horse tramways were operated successfully before electric were possible, and when the day for electric trams arrived in many of our big cities the crowding was so intense and the traffic so congested that laying a new system meant a second and big capital outlay, not to mention great hindrance to traffic. In a great many cases in America the cities can almost be said to be built round the street railways, and the dense population, which has become such a difficult problem for our town councils to deal with, does not exist to the same extent on the other side of the water. The increased convenience and healthier life of the working class shows the immense importance of rapid transit as a social factor of great power, tending to a higher civilization.

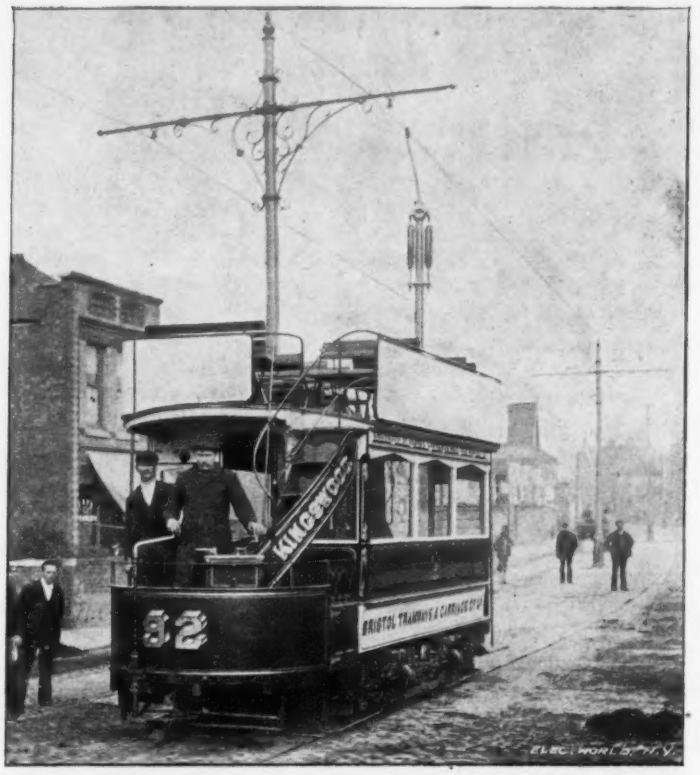
In England, also, there are greater limitations. The governing body in the cities is the corporation or town council, a body of men selected from the more prominent citizens. As they are responsible for the general welfare of the city, and spend other people's money to effect that welfare, they are somewhat naturally actuated by a sense of responsibility and their very constitution tends to conservatism. Before tramways can be laid down in any district, either by the local authority or any company, provisional orders must be obtained from the board of trade, and also if the tramway is to be laid by any other

VIEW SHOWING SIDE REACH OF TROLLEY.

body than the local authorities the consent of the local authority must be obtained at a special meeting at which two-thirds of the members are present. The Board of Trade, having given its sanction, prepares a bill to be introduced into either house of Parliament and until confirmation by act of Parliament the provisional order cannot have any operation. If while such a bill is pending a petition is presented against any provisional order comprised therein, the bill so far as it relates to the order petitioned against may be referred to a select committee and the petitioner shall be allowed to appear and oppose. This is, at the best, a tedious process, and the period that elapses between the application for and the confirmation of a provisional order is frequently two years.

Another fact deterrent to private enterprise is the famous purchase clause of the tramways act of 1870, which provides for the transference to the local authority by condemnation proceedings.

It would seem that under this act the tramways of England would in future be to a large extent municipally controlled. There is a source of danger in this, in that a company will for its own sake put in the best material, while local authorities are apt to be short sighted and simply aim at getting the thing done as cheaply as possible in the first case, forgetting that their future maintenance expenses will in all probability entirely outweigh the initial extra expenditure that will ensure a reliable service. Having seen what has to be done before a tramway can be laid down it is interesting to see what restrictions are imposed by the Board of Trade which affect their construction and working. The following are the Board of



OVERHEAD CONSTRUCTION, BRISTOL.

Trade rules, which more particularly apply to the actual working of the tramways:

BOARD OF TRADE RULES.

Where any rails on which cars run, or any conductors laid between or within 3 feet of such rails form any part of a return, such part may be uninsulated. All other returns or part of a return shall be insulated unless of such sectional area as will reduce the difference of potential between the ends of the uninsulated portion of the return below the limit laid down in a regulation hereafter to be described.

When any part of a return is uninsulated it shall be connected with the negative terminal of the generator, and in such case the negative terminal of the generator shall also be directly connected through the current indicator hereinafter mentioned to two separate earth connections which shall be placed not less than 20 yards apart. The earth connections referred to in this regulation shall be constructed, laid, and maintained so as to secure electrical contact with the general mass of the earth, and so that an E. M. F. not exceeding 4 volts shall suffice to produce a current of at least 2 amperes from one earth connection to the other through the earth, and a test shall be made at least once in every month to ascertain whether this requirement is complied with.

When the return is partly or entirely uninsulated the promoters shall in the construction and maintenance of the tramway (*a*) so separate the uninsulated return from the mass of earth, and from any

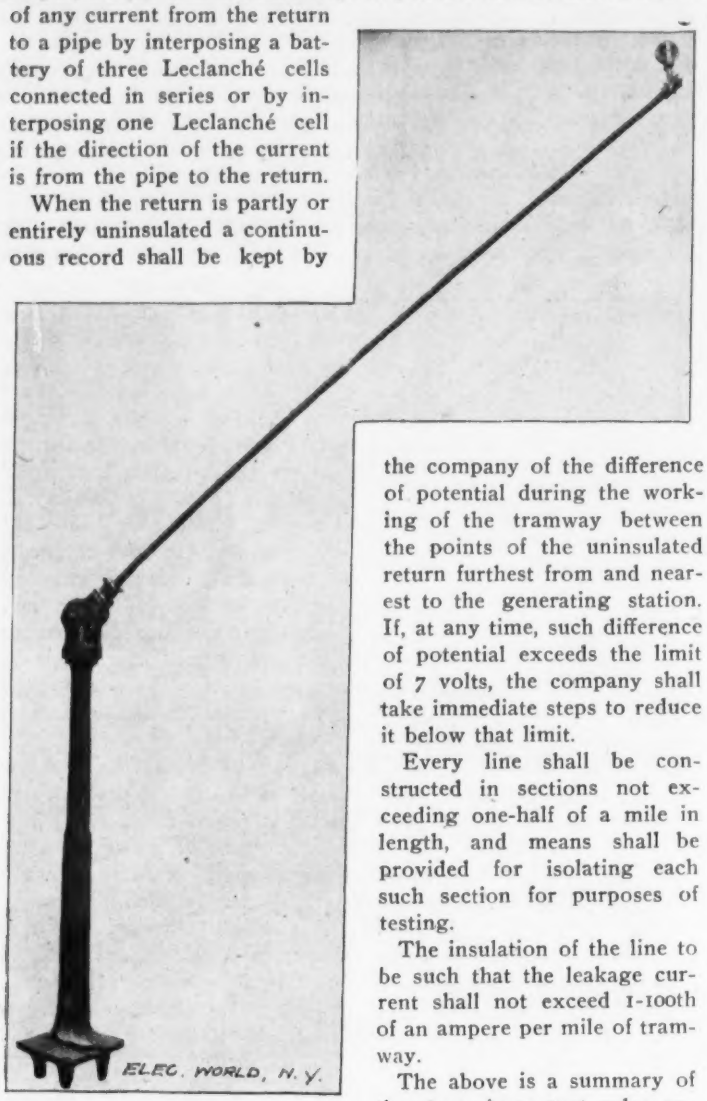
pipe in the vicinity; (*b*) so connect together the several lengths of the rails; and (*c*) adopt such means for reducing the difference produced by the current between the potential of uninsulated return at any one point and the potential of any uninsulated return at any other point, and so maintain the efficiency of the earth connections that (1) the currents passing through the earth connections through the indicator to the generator shall not at any time exceed either 2 amperes per mile of single tramway line or 5 per cent. of the total current output, and (2) that it shall always be possible to reverse the direction of any current from the return to a pipe by interposing a battery of three Leclanché cells connected in series or by interposing one Leclanché cell if the direction of the current is from the pipe to the return.

When the return is partly or entirely uninsulated a continuous record shall be kept by the company of the difference of potential during the working of the tramway between the points of the uninsulated return furthest from and nearest to the generating station. If, at any time, such difference of potential exceeds the limit of 7 volts, the company shall take immediate steps to reduce it below that limit.

Every line shall be constructed in sections not exceeding one-half of a mile in length, and means shall be provided for isolating each such section for purposes of testing.

The insulation of the line to be such that the leakage current shall not exceed 1-100th of an ampere per mile of tramway.

The above is a summary of the more important rules applying to the overhead trolley system. It will be seen that it requires a special panel on the switchboard for recording instruments, and there is little or no danger of electrolysis. These rules are rigidly enforced and no line is declared open until an official Board of Trade inspection has taken place.



Trolley Pole and Stand.

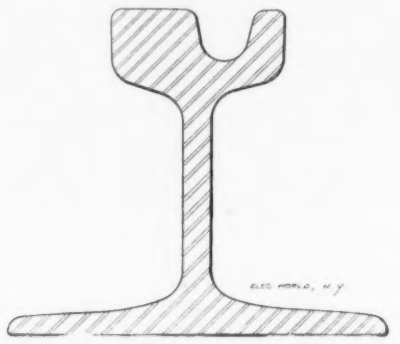
A glance at the history of electric traction in England shows that the first lines were laid in 1884; since then we have stood still and it is only now that we are beginning to realize what we ought to have done. The result is that the representatives of the large American establishments, with their wide experience, do a great deal of traction work in England; hence the main difference from American practice lies chiefly in track construction and devices which we are compelled to use by our tortuous streets, local habits, etc., etc. The overhead trolley system is coming very largely into favor, and at the present moment it is the only system in use on the tramways. Great care has been taken in making it as handsome as possible, to avoid hurting the æsthetic tastes of a certain section; thus all feeders are underground, and where the side or centre pole system is used the poles have ornamental brackets and are frequently combined with arc lamps, making, in fact, a strikingly handsome piece of work, as may be seen from the accompanying illustration. It is possible that a conduit system may be used in London, but it must be recorded that in London, where the need for electric traction is greatest, the longest time will in all probability elapse before it is used.

At the present moment it cannot be said that there is any reliable surface contact system in the market. It is possible that if a good system were invented, and one that was not exorbitantly expensive, as compared with the trolley system, it might find favor in England.

Accumulators have been tried at Birmingham, but their working has not proved a financial success, and English engineers are waiting, like others, for the invention of a traction cell which will be a commercial possibility, though it must be admitted that this system has found some success in Germany, and the electric cab is becoming quite a common sight in the streets of London. Returning to the trolley system the Dickinson side system is used in England, partly on account of the tortuous streets, and partly because the English people demand double deck cars. In the Dickinson system the trolley wire is not necessarily over the centre of the track and can be as much as 10 feet from the centre; this permits of a much greater use of the side pole system, not only making it possible where it would otherwise be impossible, but allowing of a short bracket arm. This requires, of course, that the trolley should have a swivelling head, and, in order that the trolley arm be out of the way of passengers, it must swivel about a standard at least 6 feet high.

The head is completely insulated from the pole and carried on a ball bearing about which it is free to turn. The wheel of the latest type is fitted so that its centre is level with or below the end of the pole, in order that if the wheel leaves the wire it cannot catch in span wires or bracket arms.

The pole is constructed of a tapering steel tube, thoroughly insulated with rubber, which is painted with "P & B" paint. The socket in which the pole is held and from which it is insulated is mounted on ball bearings, the bearing being carried by the standard bolted to the car roof; the electrical contact between fixed and rotating parts is maintained by contact plates pressed together by springs; thus the cable itself is never subject to a twisting stress. The springs for pressing the wheel against the wire can be either enclosed in a box or carried externally.



Cross Section of Rail.

As regards track construction and rails the regulations compel the use of such a shape of rail that it does not in any way project above the road surface. It will be noticed from the cross section shown that the groove is deep and narrow, and it rarely happens that the traction coefficient falls below 30 pounds per ton with this shape of groove, as there is little chance of any dirt getting pushed out of the groove and thus the wheel frequently runs on its flange. The tendency in track construction is to make a very solid track.

The Annual Report of the South Norwalk Municipal Plant.

The fifth annual report of the Board of Electric Light Commissioners of the city of South Norwalk, Conn., has been issued for the fiscal year ending October 12, 1897. This small plant, which has been previously described in the technical press, consists of a 125-hp horizontal tubular boiler, a 100-hp Ideal high-speed engine, and two 60-light Western Electric arc dynamos. The report for the year shows that on an original investment of $20,000, the actual operating expenses for the year were $3662; interest, $910; depreciation, at 5 per cent., $785, making a total expense account of $5357. The number of lamps in regular service was 100 of 1200 nominal candle-power each, running an average time per night of seven hours, making an average cost per lamp per night of 17.4 cents. The lights were not burned on moonlight cloudless nights, so that the total number of running nights during the year was 308, the cost per lamp per year being $53.57.

Tests of the Synchronograph on the Telegraph Lines of the British Government.*

BY ALBERT CUSHING CREHORE AND GEORGE OWEN SQUIER.

In April, 1897, a paper was read before the American Institute of Electrical Engineers, describing the general principles of the synchronograph and the experiments at that time completed in developing it.** Since then opportunity has been presented to make trials on actual lines of considerable lengths and having different distributed capacities. The tests were made over loops of varying lengths from the General Post Office, London, where both transmitters and receivers were located.

The apparatus available for experiment comprised a high-frequency alternator, giving practically harmonic waves from 50 to 720 complete waves per second; actual telegraph lines with values of *KR* varying from 0 to 261,000 and resistance varying from 0 to 10,000 ohms; an artificial submarine cable representing within 1 per cent. of accuracy an actual cable of 180 knots in length, and also the latest types of Wheatstone transmitters and receivers, with adjustable condensers, etc.

The longest loop tried was 1,097 miles, from London to Glasgow, Aberdeen, Edinburgh, and return to London by a different pole line. This contained some iron wire and also 48 miles of underground cable, and a total value of *KR* equal to 261,000.

It was found in the course of trials with the different apparatus that it was possible to operate the Wheatstone receiver without alteration by the synchronograph transmitter, and a test was made over the longest line to compare the efficiency of the two transmitters when operating the same receiver under identical line conditions. The surprising result was discovered that the synchronograph could operate the Wheatstone receiver approximately three times as fast as the Wheatstone transmitter on any line, provided the mechanical limit of the receiver is not already reached. The Wheatstone system operated from London to Aberdeen ordinarily employs two automatic repeaters to increase the speed. Without any repeaters the synchronograph operated the Wheatstone receiver over this line practically up to its mechanical limit. By the synchronograph method of transmission it thus becomes possible to operate Wheatstone receivers at the present speeds without repeaters anywhere in the British Islands.

One of the most important results of the trials to be described has been to emphasize the probability that the sine wave possesses superiority over other forms of wave for any speed, slow or fast.

The messages are prepared for the Wheatstone transmitter by perforating paper tape with two rows of holes at the proper intervals to secure correct signals, one row on each side. In the centre, between these two rows of holes, runs an uninterrupted series of smaller holes, which serves to feed the tape regularly through the transmitter.

A characteristic of the transmitter is the fact that the contact for the electrical circuits is not made through the holes in the paper, as in some transmitters, but by small steel rods, which pass through the holes in the paper, contacts are made and broken in another part of the apparatus by means of levers. Only the positive currents cause the receiver to make a mark. A dot, together with the accompanying space corresponds to a complete wave of current. A dash with its following space occupies twice the time of a dot with its space, and corresponds to the time of two complete waves, although in reality it is a single wave with the positive portion three times as long as the negative, and thus the mark for a dash is about equal to three dots.

The chief characteristics to be noted are that the waves of impressed E. M. F. are square-topped, and those for a dash are longer than for a dot.

An essential part of the receiver is a polarized relay consisting of a permanent magnet and an electromagnet. The armature of the receiver, to which the recording wheel is attached, is moved in one direction for a direct current and in the opposite direction for a reversed current. A small recording wheel is kept moistened with ink, and every positive current drives it against the paper, while a negative one raises it from the paper. The paper tape is driven forward by clockwork, and thus a series of marks is made upon the tape corresponding to the positive portions of any set of current waves.

*Abstract of a report to the Postmaster-General of the United States, read before the Franklin Institute, January 19, 1898.

**See THE ELECTRICAL WORLD, May 8, 1897.

In practice it is found that, when connected directly to the line and the return, and operated by the transmitter, the speed obtainable over most lines can be increased by the use of condensers shunted by non-inductive resistances and inserted in the main line. Common values of the resistance and capacity are about 8000 ohms and 10 to 20 microfarads, which would vary according to the line.

The details of the experimental transmitter used in the synchronograph experiments were practically the same as those employed in the original experiments, and described in the first paper to which reference has been made. The messages were prepared by fastening strips of paper upon the metal surface of a large wheel geared directly to the shaft of the alternator as there described.

As it was desired to make tests over a considerable range of frequencies, the small Pupin alternator used in the first experiments was again utilized for these trials. The alternator was driven by a 1-hp Lundell motor, supplied from 100-volt constant potential mains, and a storage battery was available for the excitation of the rotating field of the generator. Since the generator is in fact four alternators of 18, 22, 26 and 30 poles respectively, and the motor could be run regularly at very slow speeds as well as high, this combination with a field excitation, which could be varied at will, permitted a wide range of frequencies at any desired voltage. Transformers were used when desired. For the most rapid speeds the chemical receiver, using the formula of Delany, was employed with the synchronograph. The paper was prepared and used in the form of sheets instead of tape.

The lines first used in the tests of August 8 ran from London via Leeds to Newcastle-on-Tyne, and return to London via York.

With no earth, messages were received with ease at a frequency of 652 cycles, or 1304 alternations, per second. This frequency was limited by the fact that the greatest number of poles to the generator was 30, and the number of revolutions to produce this frequency was 2608, beyond which it was not then thought advisable to go for fear of injuring the machine.

With earth and a total value of *KR* equal to 81,518, a frequency of 165 cycles, or 330 alternations per second was reached.

To obtain a longer line with a greater value of *KR*, a second loop was made up from London via Leeds to Glasgow, and return via Edinburgh, Newcastle-on-Tyne, and York to London.

As before through this line without earth, *KR* being 31,771, a current was sent having a frequency as high as safety to the alternator permitted, viz., 652 complete waves per second, and no limit of speed due to line damping was reached, the messages being received with perfect clearness. With earth and $KR = 127{,}082$, no records were received at all on this date on account of not having at hand a suitable transformer to produce high enough potential at the slow speed of the alternator necessary. Before the next trials were made a suitable transformer was available to deal with a value of *KR* much larger than the above.

To test the fact that the messages were actually passing through Glasgow, and that the records were not being caused by leakage currents across the line at some point, the circuit was broken by the operator at Glasgow at a certain time, and restored five minutes later. Before and after the line was so broken the messages were transmitted readily, while during the time it was broken not the slightest record could be obtained.

An instructive experiment, illustrating forcibly the influence of increase of distributed capacity upon aerial wires, waas that of suddenly plugging in and out the earth connection, thereby practically changing the capacity of the line four-fold, when at the instant the earth was connected the motor would slow down and labor under the increased load.

On Thursday, August 12, it was decided to try the synchronograph with the Wheatstone receiver, which was at hand in the same room. This was done, and without any alteration of the receiver whatever it responded readily to each wave of current from the alternator. Messages were then correctly transmited and received. This was done by two different methods. First, the messages were interpreted by the portions of current omitted, as described in the former paper, the omission of a single mark denoting a dot and two marks a dash, the marks themselves meaning spaces. Second, the presence of the marks was used for dots and dashes, and one mark denoted a dot, while two or three consecutive marks denoted a dash. The marks are all regularly spaced, and the eye experiences no difficulty in reading the dash, even though it is made up of two or three separate consecutive marks instead of a single long

mark, since the length of the dash is of more moment than the continuity of the mark.

These preliminary tests developed the fact that messages could be received by the Wheatstone receiver in the laboratory faster with the synchronograph than with the regular Wheatstone transmitter. When this discovery was made the engineer-in-chief desired to make a more extensive series of experiments and try the synchronograph with the Wheatstone receiver over actual lines having a value of KR sufficient to reduce the speeds. As the Wheatstone receiver was to be used with the alternating current, the first thing wanted was a knowledge of its constants. The inductance of the instrument measured by the impedance method was found to be .875 henry for a single coil and 3.46 henrys for the coils in series. When the coils were connected so as to give opposing magnetic effects the measurements gave an inductance of .187 henry. The two coils of the receiver are wound together, the two wires being wound as one upon the spools in such close proximity that the mutual induction between the coils is at its maximum, and is nearly equal to the inductance of each coil. In such a case the inductance of the two coils in series should equal four times that of a single coil if there were no magnetic leakage, and when connected in opposition the inductance would vanish. This agrees approximately with the measurements when allowance is made for small magnetic leakage.

When the receiver coils are connected in parallel the inductance is practically the same as that of a single coil, since the two coils are like a single one having larger wire, the number of turns being identical.

Thus, with a frequency of 650 cycles per second, the reactance is many times larger than the resistance of the coil. In either case of a series or parallel connection of the coils it is 22.75 times as much.

When the receiver is used with reversing currents, such as are employed in the Wheatstone system, or with alternating currents, the impedance is the important element, and the value of the resistance makes very little difference, provided it bears so small a ratio to the impedance.*

When the synchronograph was used with the Wheatstone receiver the resistance with its shunted condenser, described above, was removed from the line, and the condenser shunted directly around the receiver. The receiver and condenser thus form a resonant circuit, and by properly choosing the condenser it is possible to increase the receiver current materially, making it larger than the line current. This is the benefit of using a condenser, but the capacity for the best effect should vary with the frequency of alternation. By knowing the inductance of the receiver and the frequency, the condenser capacity can be readily calculated. The value of the capacity for any frequency is not very critical; that is, a condenser will improve the working for a considerable range of speed.

With lines having a low value of KR, the speed of the Wheatstone system is limited to about 600 words per minute, as this is found to be very near to the mechanical limit of operation of the receiver, due to the inertia of the moving parts, the spattering of ink or other causes.

A copper aerial line having KR equal to about 30,000 will reduce the Wheatstone speed to about 400 words a minute; and when a line exceeds this it is customary to insert an automatic repeater, by which the speed is maintained over longer distances. Speeds of 400 words a minute are regularly maintained in England in commercial working, while the limit of the commercial working in the United States is considerably lower, about 200 words per minute.

The speed of the synchronograph transmitter and a chemical receiver would be greater than that with the Wheatstone receiver, because of the shorter code permissible with this receiver. There would then be no limit at 600 words due to the mechanical construction, so that the value would run up into thousands of words per minute. The speed cannot be given, as the experiments have not yet established the law of speeds for this combination of instruments.

Opportunity was presented for tests of this method of transmitting signals over the artificial cable belonging to the British Post Office, and of making direct comparisons of the alternating-current method with the present Wheatstone system over the same cable. This cable, which represents within 1 per cent. the real cable used from England to the Continent, to Ireland, the Channel Islands, etc., is made in 60 sections of three knots each, making a total of 180 knots or 207.5 miles. Each section has K equal to 1 microfarad and $R = 33$ ohms, making total $K = 60$ microfarads and total $R = 33 \times 60 = 1980$ ohms, and total $KR = 118{,}800$. The cable is of the type in which the distributed capacity is obtained by condensers placed at regular intervals along its length.

Through this cable, with a voltage of 110, messages were sent at a frequency of 93.6 periods, or 187.2 alternations, per second, using the synchronograph and the chemical receiver. The next experiment was with the Wheatstone system transmitter and receiver, using 100 volts constant potential, and a speed of 120 words per minute, equivalent to 72 complete waves per second, was reached by the post office officials.

From a long experience in the British service the basis which is there used to calculate the number of words per minute in terms of complete cycles of current by the Wheatstone system is 36 complete cycles = one word, or .6 of a complete cycle of current per second equals one word per minute. This basis has therefore been used throughout in calculating the comparative speeds, using the synchronograph with the Wheatstone receiver, so that the comparative results given are independent of the length adopted for a dash, or indeed of the particular code employed.

The cables from England to the Continent are not at present operated by the Wheatstone system, although by so doing the speed would undoubtedly be increased; but the Hughes system, by a present international agreement, is employed. By the Hughes system the messages are printed on a tape, which can be mounted on a blank and delivered.

With the experience already gained and the constants of the Wheatstone receiver measured, a wider range of experiments was planned, to include tests over each line for speed as follows:

(1) Wheatstone transmitter and receiver.
(2) Synchronograph and Wheatstone receiver.
(3) Synchronograph and chemical receiver.

Two other lines were made up, which, being used both with and without earth, were equivalent to four separate lines. One of these was a loop from London via York and Leeds to London with values $R = 2783$, $K = 11.95$, $KR = 33{,}257$, and KR with no earth $= 8314$.

Under the latter condition the synchronograph and Wheatstone receiver sent 666 words per minute, corresponding to 266.4 complete waves of current per second. The coils of the receiver were joined in parallel, and no condensers were used. Voltage, 175. In this line, where the mechanical limit of the Wheatstone receiver is reached before the speed is limited by the total value of KR of the line, it is seen how the perfect regularity, equality and shape of the sine waves materially increased the speed of the Wheatstone receiver.

With the synchronograph and chemical receiver the alternator was run higher than before, until a rate was attained of 1446 single impulses per second.

With the line earthed the Wheatstone transmitter and receiver sent 360 words per minute with a voltage of 100. The synchronograph and Wheatstone receiver sent 540 words per minute, voltage 200. The receiver coils were in parallel, and a condenser was shunted across the coils. No limit was obtained in this experiment.

The longest line as yet tested, of 1097 miles, was then made up, from London to Aberdeen via York and Edinburgh, and return via Glasgow and Leeds. A portion of the line north of Edinburgh was iron wire upon the same poles, going and returning. With no earth the total KR was 65,304.

Wheatstone transmitter and receiver sent over this line 185 words per minute, voltage 100. Synchronograph and Wheatstone receiver sent over this line 540 words per minute, voltage 215. Synchronograph with chemical receiver sent at frequency of 723 or limit at which it was safe to run the alternator. This result was higher than expected from the approximate law indicated by the preceding trials, and a reason for this was sought. The line was broken at Aberdeen, and records were still received. It was then restored at Aberdeen and broken at Glasgow, when, as before, no record was obtained. The cause of this was thought to be the inductive effect of that portion of the line beyond Glasgow, where the iron wires going and returning were unavoidably upon the same poles.

With an earth connection the total KR was 261,215, and the Wheatstone transmitter and receiver sent over this line 46 words per minute, voltage 100.

* With the receiver in circuit with the main line the inductance of the former should be considered in comparison with the resistance of the whole circuit, and its combination vectorially therewith affects the latter very slightly.—Editor.

The synchronograph and Wheatstone receiver sent over this line 135 words per minute, voltage 85, coils in series $L = 3.46$, condenser of 5.75 microfarads shunted across coils.

THE TRANSMISSION OF INTELLIGENCE IN GREAT BRITAIN.

One of the reasons for going to England was to become conversant with the method of conducting the telegraph and telephone business in conjunction with the general postal service in a country where these three departments are under the control of the Government.

In the prosecution of this, as in the experiments themselves, every facility was afforded by the Government officials.

It is recognized that to draw correct conclusions upon the general subject of the transmission of intelligence requires men of experience in dealing with such matters, who give the subject their attention for a considerable period. Some of the principal facts, however, seem to be so clearly defined in their relation to others that we feel warranted in making some observations thereon.

The telegraph revenue and expenditures have increased with approximate uniformity In 1872 the revenue was about $18,200,000, and the expenditure about $14,500,000, while in 1896 the revenue was $69,700,000 and expenditure $70,500,000. These two items have nearly coincided during twenty-five years, showing that the telegraph business is conducted on the whole to meet the expenses only and leave no profit. In some years the expenses are greater than the revenue, and the account shows a deficit. This has been the case for the last five years, but it has been gradually decreasing for three years, and in 1896 was only $168,000.

The number of telegrams forwarded from telegraph offices in the United Kingdom in 1871 was 9,850,177, and in 1896 was 78,839,610. In 1896 the ratio of the number of letters to telegrams was 18.5.

The charge for transmitting ordinary telegrams is a half-penny, or one cent, per word, including the address, independent of the distance. The minimum charge is six pence, or about 12½ cents. The telegraph is used to a much greater extent for transmitting news in England than in any other country; for instance, in 1896, 5,915,646 telegrams were transmitted at the press rates for newspapers, clubs, etc. The average weekly number of words contained in these telegrams was about 13,650,000. The average length of each telegram is therefore 120 words. The explanation of this is found in the reduced rate given to the press after 6 P. M., which is at present but six pence per 100 words. This press matter is handled almost entirely by the Wheatstone automatic system, automatic telegraphy being more advanced than in any other country in the world. There are as many as 447 sets of Wheatstone instruments in use in Great Britain, and for press messages pneumatic perforators are used, and a number of duplicate strips are prepared at once, and thus the same press news may be sent out on eight or nine different lines from London at the same time. Many of the lines, which are ordinarily operated by hand, are equipped with Wheatstone instruments. These are switched in whenever the traffic for the particular line becomes too great for hand transmission. They are also much employed for temporary lines where an unusual volume is to be handled in a short time, such as in sending the enormous amount of racing and sporting news required.

The telephone service in England is not entirely under the control of the Government. The trunk lines are so controlled and operated, leaving to private companies the service in local districts. Some of these trunk lines were transferred to the Government on March 25, 1896, by an agreement with the National Telephone Company.

In a country where the three great branches of intelligence transmission, the mail, the telegraph and the telephone, are under one management, special advantages to the people are obtained which are not given when these departments are separated. In England messages may be telephoned:

(1) For transmission over the postal telegraphs and delivery as telegrams.

(2) For delivery as express letters.

(3) For transmission and delivery as ordinary letters.

The telephone may also be used for obtaining the services of post office express messengers.

As indicating the increased demands for communication between England and the Continent the following extract from the last report of the Postmaster General is given: "The large increase in the number of telegrams passing over the Government cables to the Continent, and in the number of conversations on the telephone circuits between London and Paris, has rendered it necessary to consider the advisability of improving the means of communication. With the cordial co-operation of the German post office, experiments were made with a view to improving the carrying capacity of the cables to Germany by the method of duplex working, which has been employed with success on some of the Anglo-French cables; but, owing to the greater length of the Anglo-German cables the results obtained were not sufficiently successful to justify the adoption of the system for practical working. Arrangements have now been made for the laying of three additional cables to the Continent, two to France, and one to Germany. These cables, each of which will contain four conductors, will afford a much-needed relief to the traffic; and it is expected that this new cable to Germany will prove suitable for duplex working."

A Power Transmission Plant in the Kootenai.

The plant of the West Kootenai Electric Light and Power Company, for the transmission of electric power from the Kootenai River to the town of Rossland, B. C., is now nearing completion. It is expected that electrical energy will be transmitted over the lines not later than February 1.

The power house is located at Bonnington Falls, about 8 miles below Nelson on the Kootenai River. Water is conducted to the reservoir from the river by a canalway, 22 feet deep, cut out of the solid rock for a distance of 640 feet. The dam, which is of concrete, is 32 feet high, and 18 feet thick at the base. It extends the full distance across the forebay, some 54 feet, and is reinforced on the sides by huge abutments of concrete. The average rise of the Kootenai River is 22 feet, and the highest flood on record was 32 feet above the minimum height of the stream. The dam is calculated to withstand the severest floods which it is likely to encounter. From the forebay the water is carried to the turbine wheels by three steel penstocks, two of which are 9 feet in diameter, while the third is 10 feet in diameter. At present only the two smaller penstocks will be used. The wheels are two in number, of the twin horizontal type, manufactured by the Stilwell-Bierce & Smith-Vaile Co., of Dayton, Ohio, and will develop 1250 horse-power each, so that their combined power is 2500 horse-power.

The turbines are directly coupled to the generators without the use of gearing or belting. The gates for regulating the water supply are electrically governed.

There are two generators, having together a capacity of 2500 horse-power. They weigh as installed 65,000 pounds each, the waterwheels weighing 40,000 pounds each.

The generators have been purchased from the Canadian General Electric Company, and are of the three-phase, revolving-field type, giving a voltage of 1040 when revolving at 180 r. p. m. The exciters for the generators are operated by two special turbine wheels. The generators are connected by heavy cables to the instruments on a marble switchboard, from which the current is led to step-up transformers, which raise the pressure from 1040 to 20,000 volts. The high pressure current is conducted to the sub-station at Rossland over a three-wire line 31 miles long. The local sub-station, which is situated on the Monte Cristo ground, is equipped with a high potential switchboard, a distributing switchboard and a series of transformers which reduce the pressure from 20,000 to 2080 volts. From the sub-station electric power will be conducted to the various mines, which will utilize alternating motors for their driving power. It is the intention to use motors to drive the air compressors of the mines.

The president of the company is Oliver Durant; Robert Jamieson is the general manager and engineer, and L. A. Campbell, of the Canadian General Electric Company, is the installing expert.

A Small Isolated Plant.

An electric generating plant for the supply of fourteen 8-cp lamps and one 32-cp headlight is mounted in the "composite" car recently supplied to the Erie Railroad for suburban service near New York City. The car is 50 feet long, fitted with boiler and steam propelling mechanism on one truck, and baggage and passenger compartments. It is intended to take the place of the two-car train and locomotive, and thereby reduce the cost per train mile and allow a more frequent service, similar to that offered by the competing trolley roads. The lighting unit consists of a Pyle-National electric headlight motor.

Electric Lighting for Profit.*

BY ALEXANDER DOW.

This subject is one which every member of this association has studied, and concerning which every member must have opinions. I have selected it for the paper which your secretary asked me to present at this meeting, because I have opinions of my own which I think may be of interest to other electric light men, and which I want to hear discussed and criticised and contradicted by you who are qualified by experience to do so.

I submit as the first proposition that we are all in business to make a profit. I don't expect to be contradicted on that proposition, although some may wish to so amend it as to indicate that they are at present content if they can avoid a loss. As a second proposition I submit that the conditions of the electric light industry have so changed in the last few years that the opportunities of profit are limited; that the margin between earnings and expenses tends to vanish, and can only be kept in view by unceasing endeavors to increase the one and reduce the other. The days have departed when a neat dividend could be paid on a small business done at high prices; and now, if a dividend is to be paid at all, it must be earned by doing all the business that can be obtained and at prices set but little above the actual cost of production. As the preceding statement forms the text of this discourse, I ask your attention to its repetition, as follows: I believe that the proper policy of electric light management under the conditions of the present time is to sell electric energy to every accessible user, in any shape that the user requires, and at the lowest price which will pay a reasonable profit on the capital invested.

Those of you who were in the business at its beginning will recognize in this profession of faith the converse of the rule which then governed us. We used to believe in a "System," and the people who taught us to so believe charged us so much for the experience and the incidental machinery which we required that we in turn had to collect great prices for the product sold to our customers. The rule was to get out of the business all that it would stand; and if a possible customer did not like the particular kind of energy which our "System" furnished," and thought he would like the kind which some other alleged system was supposed to produce we considered him a heretic. Electric light was then a novelty and a luxury and a mystery, and was to be respected and paid for accordingly. Nowadays it is a thing of domestic use; the machinery for its production is sold as freely as any other machinery; the principles governing its distribution are taught to all who desire to learn, and its supply is recognized as a customary or even necessary public service exactly as is the supply of gas and water. It is proper that we should announce a policy suited to the new condition. That many have done so, and also that some have long been governed by just such a policy as I advocate I know, but there still remains, to the detriment of the business at large, some who are trying to run their affairs on the old plan. They do not profess to do so, and if challenged they may plead the old excuse—that the cost of their plant and the losses incident to its first operation have been so great as to require high prices for the energy sold. That excuse is not valid in these latter days. Taxing customers all they will stand means competition either by an opposition plant or by the municipality, and either of these means ruin to the station which is run on the old lines.

Of course, I do not intimate that any member of this association is managing his business to-day after the fashion of the eighties. But each of us knows of some plant in the next town to ours which is run just that way. That plant is going to fight it out on the old line until it is wiped out by a municipal plant, and the municipal plant will publish a report to the whole United States that it has reduced the price of lighting 30 or 40 per cent. Then you and I and each of us is going to have the trouble of explaining at great length to our own particular municipal authorities why a municipal plant established in our town cannot possibly make any similar reduction.

The man who used to sell experience to us is probably to-day trying to show the ambitious city fathers of that other town next to ours how well they can serve their constituents, and how much honor they can obtain from society at large by engaging their municipality in the electric lighting business. Our friend, with experience to sell, is not one bit more exact in his statements than he used to be long ago, and we cannot honestly say that his operations are beneficial to our business, but he is less detrimental than the man who gives him a chance to get in his work, the man who ought to be giving good service to a satisfied constituency, but who is furnishing lights that are a disgrace to the "System" and its owner, and trying to collect higher rates than those at which you and I are giving first-class service to our public.

What is a reasonable profit? This is a much discussed question. The man in the next town believes that a reasonable profit is everything he can get, and at the other extremity of belief is the man who holds that no public service should pay a profit to any individual. Between these limits will be found the opinions of the great majority of Americans, whose democratic training has taught them that the commonwealth should not undertake any work which can be satisfactorily performed by private enterprise. Those members of this great majority who have money invested in manufacturing or in commerce recognize that a reasonable profit means something more than can be obtained by the investment of their funds in Government bonds or by placing them in a savings bank, and yet something less than is hoped for when the investment is of a speculative character, involving risk of total loss of capital, such as the exploiting of a new mine or the insurance of an overdue vessel and its cargo.

I believe that after operating expenses are paid and any deterioration of the investment shown by a carefully made inventory has been made good, a dividend such as is paid by a good manufacturing business is reasonable for electric lighting. Such a dividend will necessarily vary with the line of manufacture, those concerns who manufacture a staple having a practically constant market being satisfied with a narrower margin of profit than those others where the production has to be varied from time to time, and new markets developed at intervals.

The same considerations govern in the electric lighting business. A station which is well established, has no ruinous competition to meet, is not threatened by municipal interference, and is not obliged to continually risk money in extensions of an uncertain character, may well pay a dividend but little in excess of the current rate of interest in savings banks. The station in which all these conditions are reversed, particularly when there is a prospect of its investment being wiped out by causes which its management cannot control, is entitled to a greater return.

There is much work to be done in the education of the public to a proper understanding of the economic principles underlying this subject. The citizen who has theories about municipal service does not apply these to his own affairs, nor will he apply to his theories the rules which govern his personal practice until you show him that this should be done. He thinks it no harm that he should draw from the capital invested in his own business 10 or 15 or 20 per cent. in addition to a fair salary for management and any loss that is shown by annual inventory. He thinks it entirely proper that he should build up a business worth much more than its nominal capital by returning into it a large annual surplus. But he will denounce as extortionate an electric lighting company which pays a good deal less than 10 per cent., and for such a company to show a surplus is in his eyes prima facie evidence of robbery of the public. He, on the one hand, refuses to protect the public service corporation from unlimited competition, and on the other hand demands that it do business for a rate of profit accepted only on the safest class of investment bonds.

In Europe they are more logical. They limit the price which a company may charge to its customers and the dividend which it may pay to its stockholders. They require the company to give good service to all who demand it within a certain area. But at the same time they permit no competitor to enter the same district, and they provide for the purchase of the property at a reasonable price in the event of the franchise not being renewed at its expiration. Where they restrict they also protect. Our theorists have yet to learn that these two actions should go together, and it seems to be our affair to teach them this lesson.

There has been of late much discussion of the subject of rates at conventions and in the electrical press, and with good reason. American practice has heretofore been to make rates without sufficient analysis of cost, and particularly without attempting to make each unit of energy sold bear its proper share of the standing charges of the plant. Premising thaat we are to readjust rates for a minimum profit, we must do so according to a carefully considered system. It will not do to make a horizontal cut on the present schedules because analysis will show that some business now done at the highest rate is not profitable and a reduction of rate should only be made on business that is profitable.

* Read before the Northwestern Electrical Association, January, 1898.

It has been said that American customers insist on a uniform rate—a "one price American plan" method of charging. I do not find it so. I have no difficulty in explaining to those customers whom I meet why some business should pay a higher rate than other business, and other electric light men tell me that, after they have got the principles involved clearly defined in their own minds, their experience with customers is similar to mine.

The base of any system of rate making must be analysis of the costs of production. The method of analysis which I have found most useful is that proposed by Mr. Arthur Wright. The paper read by that gentleman at the last meeting of the National Association is doubtless familiar to you, but as American conditions usually differ from those existing at Brighton it is seldom possible to apply the short method of estimating standing and running costs which Mr. Wright found convenient, and an analysis in detail must be made. I use the following method: Consider what the condition of the station would be if you were obliged to be ready to do the same business that you now do, and during the same time, but had no customers taking current. You would have fires lighted, men on duty, dynamos turning over, lines strung and connections made to customer's premises. You would burn enough coal to keep up steam and keep the dynamos in motion, and you would have enough help for these conditions. But you would not burn so much coal as if the machinery were running at full load, and you might need less help. Your lines would be out in the weather or buried in the ground, and that deterioration which is due to time and to climate would go on just the same and would have to be made good by a repair gang. But you would not need renewals of incandescent lamps or carbons, and you would not keep any men to put in fuses for customers or to read meters. You would need a manager and an engineer and an electrician, just as you do now, but you would not need a bill clerk nor a collector, and you might do without an office boy. My rule is to ask whether the item of expense under consideration would continue or would cease under the conditions described. If it would continue it is a standing charge. If it would cease it is a running charge. It is clear that taxes, insurance and interest are standing charges.

Mr. Wright has shown us that it costs us a great deal of money to get ready to serve a customer, even though the customer only requires service for a single hour in a year. This amount he calls the standing charge. He has pointed out that a uniform rate takes no account of this, but is apparently based on the assumption that it costs just the same to furnish current to a customer for one hour in the year as for each hour of 1000 hours in a year. He argues correctly that in making rates we should take account of a customer's load factor, and he goes on to describe an ingenious method and an ingenious device invented by himself for taking such account. Whether we adopt his device or not we must all admit the correctness of his statement of the conditions governing costs of production, and we must, if we are hereafter to do business at a profit, make our rates with a due regard to these conditions.

To discuss in detail the whole theory and practice of rate making is beyond the scope of this paper. I advise each of you who has not already done so to make analysis of your costs in such manner as to distinguish between standing and running expenses. Using Mr. Wright's paper as a text book you will find (as I did) that the labor is well paid for by the results obtained. Properly tabulated these results will show what business is profitable at any given rate or what rate should be made on any given business. My analysis showed me that I could afford to sell current to a large class of users at 4½ cents per unit, while a rate already established at 14 4-10 cents for another large class was not profitable. Now I am taking all the 4½-cent business I can find, and am letting other people hunt for the 14 4-10-cent kind.

The immediate business of an electric lighting station is to supply incandescent and arc lighting and power for stationary motors.

Some small plants limit their business to lighting, and thereby avoid operating during the daylight hours. I think that this is often done without good reason. There is in nearly every village some demand for power, or such a demand can be developed by an enterprising manager. It is likely that the rates to be obtained for power will be very low, but if they will pay the additional cost of running the station during the daytime and also carry some proportion of the standing charges these low rates may be profitable indirectly by reducing the amount of standing charges remaining to be earned by the lighting business. It is certain that interest, insurance and taxes run for twenty-four hours a day, although the plant may only operate for twelve, and if the power load will pay half of these items in addition to its actual running cost it is worth having.

Some stations do not run all night. The people in the village where such a station is located may go to bed early, and may not use any appreciable amount of current after 11 o'clock or midnight. But I have always found it difficult to work up a good business in residence lighting unless the plant undertook to give all night service. Apparently customers do not care to have a duplicate lighting equipment in their residences. They do not fully appreciate the beauty of incandescent lighting if it cannot be switched on at any moment when it is wanted. People sometimes want lights between midnight and morning in their houses, and I suppose will continue to do so as long as our children come into this world with unreasonable ideas as to the part of the day in which they should do their sleeping.

I am sometimes told that residence lighting is unprofitable. It surely is if every residence that is served requires an independent transformer, and if only one residence in a dozen takes current at all. The only way to do residence lighting at a profit is to do all the lighting or nearly all that there is in a given residence district, and for this purpose the rate must be placed so that every possible customer can afford it. I have tried the experiment of low residence rates on a small scale more than once, and in each instance with success. It is to be tried now on a large scale in several stations, and I am certain that the experiment will be successful. The load factor of residence lighting is much better than the average load factor of many stations.

It is a serious handicap to a station when it is obliged to run two or three separate types of dynamos and to maintain two or three separate distributing systems for the supply of different shapes of energy. The best practice to-day is to furnish incandescent lights, arc lights and electric motive power from the same dynamos and same mains. This is a subject to be considered in the original plan of the station, but there are instances where old stations have been rearranged with decided financial advantage. When a power load can be had even at the low rates already spoken of, a study of the local conditions should be made with a view to seeing whether a general distribution system will not be a source of profit. To design a new station with anything but such a system is almost criminal.

There has not yet been devised a satisfactory system whereby a supply of 500-volt current for railway work can be combined with a general lighting distribution. Therefore, a proposal that a lighting station should furnish such current must be dealt with as involving a new investment. This investment is always the cost of the dynamo and switchboard, and usually the cost of an engine. The street railway evening load in winter time coincides with the heaviest load on the lighting system for about 200 hours per annum. At all other hours the street railway demand is a desirable addition to the load on the boilers, and in most stations the dynamo and switchboard can be cared for without cost for additional help. If the boilers are properly designed to suit the conditions they may be driven beyond their usual rate during these 200 hours with greater profit than would be possible if additional boiler capacity had to be installed. Furnishing street railway current appears therefore to be equivalent to the sale of steam to a special engine and the furnishing of attendants to an additional engine and dynamo, and it should be considered as a business proposition on that basis and not in the same manner as a demand for current from the electric lighting plant.

If street lights can be served from a general distribution system, the rate should be made in the same manner as the rate for any other service from that system. As street lights usually run about 4000 hours a year, a rate made on a scientific basis will be very low in comparison with the rate for ordinary commercial lighting. This is not in accordance with the old practice of making all the profit of the business on a street lighting contract, but it is distinctly in accordance with the more modern practice which will probably become general. Municipal contracts which can be performed without investment in special machinery are desirable business in that the payment is prompt and absolutely secure, and that the conditions of their performance are clearly laid down in the original agreement. For that reason the tendency appears to be to take such contracts at a very narrow margin of profit.

But when the performance of a street lighting contract requires an investment in special machinery and the building of special lines such a contract is usually undesirable business. It is impossible under present conditions to secure such prices for street lighting

as will return the investment to the stockholders with the term of the contract. The contracts are usually short, and there is no security of their renewal. If, in dealing with a municipality, one were dealing with a business corporation having an established policy it would be justifiable to take such chances, but our American cities, if they have a policy at all, change it from election to election, and no contractor can tell that the service which was deemed perfect by the board with whom he made his contract will not be entirely unsatisfactory to their successors, with whom he must make a new contract two or three years hence. In this respect we have another lot of educational work cut out for us. If we could make it clear to the mass of our citizens that the price for a year's street lighting depended on whether the street lighting plant would be employed next year or would be standing idle, we might have some chance to make close bids without feeling that we were engaged in a risky speculation. The peculiarly exasperating part of the whole subject is that those same theorists who object to asking for bids on a contract running more than two or three years are usually ready to lock up the good money of the citizens in a city plant, which has to be security for thirty-year bonds.

In these days of competition holding business after it has been attained becomes of the greatest importance. We have against us in every station some competition. In the larger cities we have to meet the offers of opposition companies doing a similar business to ourselves, the arguments of the man who wants to sell isolated electric plants to our best customers, and the ever present cheap service offered by the gas company. In the smaller towns and villages the worst obstacle to the holding of business is the tendency of our customers to economize by cutting down the amount of light used. This tendency is present also in the large cities, but is not so constantly in evidence because many city people must use light liberally in order to carry on their business. The whole law and gospel of holding business consists in getting your customers to believe that they receive good value for their money. It is not sufficient that you should believe it; you must convince the customers. But it tends to make your success more certain if you know in your own mind that you really are giving good value. For this reason it is essential that you know what each block of lighting costs, which brings up again the subject of analysis of expenses.

No matter how cheaply you offer to sell your products, it is essential that the customer is satisfied with what is delivered to him. Therefore, if he wants to use arc lights you must see that they are quiet and steady. If he buys current from you wherewith to operate a motor, you must make it your business to see that his motor runs satisfactorily. It is not a part of your contract to do this, but if the motor does not run as it should you will go up there some day and find that he has bought a gas engine. If you sell him current for incandescent lighting, you must see that the lamps are renewed before they become dim. If you cannot get the customer to buy new lamps, you would better arrange to furnish renewals free, as most stations now do. If even then your customer is slow about calling for renewals you would better send one of your men up to change the lamps. Neglect in this respect probably means that there will be a sale of Welsbach burners in the neighborhood of that customer. You must be prepared to send assistance to him when he mixes things so that fuses get blown, and you must send this assistance promptly. This may mean that a man has to idle around the station for trouble calls, but you should not think that man's idleness gives you a chance to economize by discharging him. You should look upon it as the outward and visible sign that your customers are getting good service. And above all, you must take such precautions that your service may be relied upon by all who employ it. There is nothing that does so much to damage the business of a station as a reputation for unreliability.

In closing I wish to say that I am preaching no doctrine which I do not believe or which I do not try to follow. It is by electric light men and no others that the advice must be given to those who need it.

This is a final summary of the opinions I have presented: (1) The electric lighting business should pay, as a reasonable profit, approximately the same rate as any manufacturing business which has similar risks. This profit should be paid after the expenses of operation, maintenance and depreciation shown by annual inventory have been provided for. (2) Rates for electric supply should be so adjusted that each unit sold will pay its share of operating and standing charges, and in addition thereto a uniform proportion toward profit. No business should be done at a loss, and no business should pay more toward profit than its proper share. (3) Every class of business that can be profitably done should be obtained. Business that improves the load factor should be taken if it can be obtained at any price greater than its share of operating and standing charges, because the improvement of the load factor reduces the amount of standing charges to be borne by the existing load. (4) Business once obtained should be kept by careful study of and prompt attention to the requirements of each customer. It is not possible in the present stage of electric development for an American electricity supply company to limit its interest in the supply to its delivery on the customer's premises. It must do much work in order to secure that the customer uses the supply to the best advantage. It is not sufficient that a customer should be well served, he must also be well pleased. (5) There is need of educational work to be done among electric light men, among municipal authorities and municipal theorists, and among our own customers.

It is our interest that this educational work should be done, and as it does not appear to be the duty of any other person to do the work, we will have to do it ourselves.

[The discussion of Mr. Dow's paper, which will be found in the convention report in another column, contains much interesting matter of the same general character as the above.—Eds.]

Meeting of the Indiana Mutual Telephone Association.

The annual meeting of the Indiana Mutual Association of Independent Telephone Concerns was held in Indianapolis, on January 19.

The morning session was of the nature of an "experience meeting," the different managers telling of their progress and their methods in meeting competition. President E. H. Andress, of Lafayette, stated that the independent business is on the increase, both in number of exchanges and in lines per exchange. The Home Telephone Company, of Fort Wayne, reported that it has 1400 subscribers at rates of $36 per annum for business houses and $24 for residences, a further rate of $48 being made for subscribers with both services. The company has 700 miles of wire reaching other towns in Indiana and Ohio. It is stated that the Home companies are rapidly connecting their local exchanges with smaller towns near them, and it is expected that soon all the central stations in the association will be so connected as to give a good long distance service.

At the previous annual meeting a committee had been appointed to confer with similar committees of the independent associations in Pennsylvania and Ohio. The report of this committee showed that in the three States there are 250 independent exchanges with more than 100,000 subscribers, and with an invested capital of more than $5,000,000. There was reported a rapidly growing demand for more extended service, approaching what is known as long-distance work. That this demand might be met committees had been appointed from the three States with the object of forming an alliance whereby the long distance lines might be established. It was recommended that the independent exchanges be, if possible, incorporated into one company with sufficient capital to build the connecting lines.

International Meeting of Light and Electrical Associations.

At a joint meeting of the executive committees of the Texas Gas and Electric Light Association and the Texas Street Railway Association, held at Austin, Tex., January 16, L. T. Fuller, president of the former association, presiding, it was decided to hold a joint meeting of both associations at Laredo, Tex., on March 9, 10, 11 and 12, 1898. Several officials of electrical companies in Mexico having expressed a desire for closer acquaintance with their United States neighbors, it was the sense of the meeting that the convention be made an international meeting of the two Texas associations above mentioned, and of the gas, electric light, street railway and power men of Mexico, a joint invitation of both associations being extended to the Mexicans, with a promise that a part of the programme would be devoted to papers to be prepared by them. A general programme was outlined including proposed papers as follows: "The Advantages of Associate Work," by Carl F. Drake, of Austin; "Meter Versus Flat Rates," by J. R. Cullinane, of Dennison; "A Chapter on Accidents," by George B. Hendricks, Fort Worth; "The Use and Abuse of Electrical Machinery, Apparatus and Appliances," by Harry L. Monroe, Dallas. The programme also contemplates attractive excursions to the gold and silver mines of Monterey and to "El Toro." Committees were appointed on arrangements and transportation.

Electricity in Municipal Engineering.*

BY R. B. OWENS.

My object in presenting this paper is to emphasize the economy which can often be effected by generating at one point all the power required by a municipality, and its distribution for whatever purposes, by electrical means.

But I am not to be understood as advocating the community ownership and operation of any interest which can be as well administered by individuals. I only wish to show the economy of combining the several problems in municipal engineering involving the use of power, and to point out a further considerable field for the use of electrical apparatus.

The several principal problems referred to are, of course, the supply of water, the disinfection and disposal of sewage, the destruction of ash-bin refuse and street lighting.

When a city is so fortunate as to be able to get good water from a nearby river or lake, with or without pumping, much that I have to say will not apply. But in the mapority of cases in our flat Western country water is only obtainable from wells, driven or dug, and when a considerable amount is required, as for municipal uses, it is generally necessary to separate the wells as far as practicable, because of the limit to the supply which can be continuously obtained per unit of volume of water bearing strata.

In small towns of a few thousand inhabitants, where the underflow is good, it is usual to find driven wells 10 to 20 feet apart and a direct acting steam pump over each, an arrangement which, as a rule, requires the construction of a railway siding for rapid coal supply. In cases of this kind I have recommended power pumps driven through a countershaft by an engine of economical design. To the same countershaft one or more dynamos can of course be attached. Now, if both dynamos and pumps are driven by clutch pulleys it is possible, by shutting down the pumps as the dynamos are started, and varying the number in operation as the lighting load varies, to keep an almost exactly constant load on the engine—the most favorable condition for its economical operation.

In larger towns of from 50,000 to 60,000 inhabitants and upward, it is not unusual to find half a dozen pumping stations from one-half to 1 mile apart, each with a full complement of boilers, steam pumps and attendants, and the whole operated apparently as much in the interest of the coal dealers and those on the pay roll as for the taxpayers. A one or two-cylinder pump without fly wheel, lifting from a single dug well and discharging directly into the mains is usual.

In a case of this kind recently coming to my notice, I urged the immediate substitution for the steam pumps of an equal number of triplex power pumps, operated by constant torque variable speed motors, the current for such motors to come from a central power plant equipped with economical machinery and suitably located.

The annual saving as the result of such a change was estimated to be more than 50 per cent. of total cost of operation. It might be remarked here that the recent appearance of satisfactory constant torque motors, in both alternating and direct current types, for operation from constant potential circuits removes the last difficulty in the most general application of electric power, and now it confidently hoped that nonexpansive steam working, as in boiler feed pumps, drain pumps, etc., in our lighting and power plants, and also in many cases of pumping from wells against a constant head for city and other supply, will soon become a thing of the past.

Chemical methods of sewage disinfection, when effective, are expensive, and it would seem that electrical methods must supersede them in the future. The two principal methods of manufacturing a disinfecting fluid by electricity are Hermite's and Woolf's, the former being used principally on the Continent and the latter in this country. They do not differ much except in detail. In both systems the disinfectant is obtained by passing a large current of electricity at low pressure through sea or salt water, prior to, or after being mixed with the sewage. From this results the formation of certain hypochlorites, hypobromites and iodine compounds, which latter are for the most part in the form of iodates, all strong odidizing agents, directly or indirectly.

Where a common drainage and sewage system is adopted, the disinfecting liquid may be greatly diluted during a storm, but the trouble is obviated by the adoption of separate systems or by the use of a reservoir holding a considerable quantity of the liquid to be discharged into the sewage system in times of heavy rains.

One installation of the Woolf system reported consists of a 15-hp engine, with suitable dynamo, tanks, etc. A bacteriological examination made by competent persons showed almost perfect sterilization. This plant is considered sufficient for disinfecting the sewage of 30,000 population if run continuously.

At usual rates for fuel and attendance, the cost per inhabitant per annum was shown to be about 25 cents. A similar cost per inhabitant has been obtained elsewhere.

It will be seen, however, that this figure can be reduced to a small fraction of itself if the system were operated as a part of a combined plant instead of as a small separate one. As compared with other systems of sewage purification—chemical, land filtration or a combination of chemical and land systems—the cost per inhabitant per year by the electrical system, even when current is supplied from a special plant, is apparently less by from one-half to two-thirds.

Another important point to note in this connection is that the electrical system, while cheaper and in general more effective, requires power at practically a uniform rate, a condition fitting in very perfectly with the economic operation of a pumping plant, and the requirements of a plant to burn and utilize town refuse.

The matter of disposal of ash-bin, or, more generally speaking, town refuse, has not received the attention it deserves. There is but one successful method of handling it, and that is to burn it; but town refuse has a calorific value equal to about one-fifth that of ordinary coal, and consequently may become, with proper arrangements for its burning, a source of profit instead of an expense.

A difficulty in utilizing the heat energy of town refuse for street lighting is that it requires to be burned at a very regular rate the twenty-four hours. To meet this, the so-called thermal system of energy storage has been devised, but since the power required for pumping, supposing some reservoir capacity in the water system, and for the electrical purification of sewage is in many cases practically constant and, more than that, obtainable from the refuse, a combination plant would save the expense of such a thermal system and accomplish as much.

It has also been proposed to use such a thermal storage scheme in connection with lighting plants having a poor load factor, but it may be seen that the following scheme is equally effective, and involves very small extra cost. Instead of using separate thermal storage tanks, by carefully lagging the entire boiler setting and providing removable insulating covers for the fire and ash-pit doors the boilers themselves may be converted into heat reservoirs. When one boiler of a battery is to be put out of service the fire is allowed to burn as low as possible and the boiler well filled with water, then the fire and ash-pit doors are closed and covered and the main steam valve to the header shut tightly, as well as the damper in the smoke flue. Any further steam generated by the remaining fire on the grate and by the heat of the setting finds its way into the header through a by-pass about the main steam valve. In this by-pass is placed a difference-of-pressure value to operate whenever the boiler pressure exceeds the pressure in the header by a certain desired amount. The rate of loss of pressure or heat by such an arrangement can be reduced to an extremely small quantity. Now, when the boiler is to be put in operation again it has a pressure equal or perhaps greater than that of those in service, and brings to their immediate aid its volume of stored energy on a sudden demand for steam. By providing arrangements for starting fires with oil when necessary the stand-by boilers in a battery can be put into full operation at the rate of perhaps one a minute, or in any case quickly enough to meet such sudden demands for steam as can occur in practice. I have recommended such a method of handling boilers in small city pumping plants, where, during the time steam is not required for pumping for ordinary purposes, the fires are banked for quickly getting up steam in the event of a fire. This scheme would save practically all the coal required for banking, which occasionally amounts to nearly one-half of all the coal used.

Ash-bin refuse is burned in a special furnace, usually with automatic attachments for uniform feeding. These furnaces, though commonly called destructors, might better, as has been suggested, be called utilizers. In Great Britain there are more than fifty towns in which destructors are at present used. In this country, unfortunately, there are few.

* Paper read before the Northwestern Electrical Association, January, 1898.

By burning the refuse is reduced to about one-third of its weight and one-fourth of its bulk. The residue after combustion consists of clinkers and ashes, which are valuable for road making ballast. In the earlier forms of destructors the temperature was not high, but in more recent ones designed to be odorless the temperature of the gases is 1500 to 2000 degrees Fahr., and the addition of a suitable boiler to absorb their heat is not difficult. Ordinarily ash-bin refuse will amount to from 1 to 4 tons per inhabitant per year. Of course, such refuse is a poor fuel, and as it burns with difficulty, would seldom be used for steam making. However, it should be burned for sanitary reasons alone, and any profit from the utilization of the heat resulting is clear gain.

For street lighting electricity alone needs be considered, as the demand for electric illumination is almost universal. But the peculiarity of municipal lighting as compared with ordinary commercial lighting is the constant power required while the lights are in use, a feature which again lends itself happily to combination with a pumping plant and plant for sewage disinfection. Also in many cases it will be found that the amount of power required for lighting is not far different from the amount required for pumping. Now, from what has been said it will be evident that in many cases a combined plant can be designed to burn and utilize the ash-bin refuse, do the pumping of water from a series of scattered wells, and supply current for street lighting and sewage disinfection, in which all the machinery will be loaded very nearly to its full capacity twenty-four hours a day.

The extremely uneconomical machinery used for pumping in many places to-day, and the demand for better sanitation, offers, it seems to me, a very considerable further field for electrical machinery, and one which I trust will not long remain uncultivated.

The Present Efficiency of Incandescent Lamps—I.*

BY JOHN E. RANDALL.

The present efficiency of incandescent lamps for central stations lies somewhere between three watts and three and three-quarter watts per candle-power. It might appear from these limits that no advance had been made in the lamp industry during the last thirteen or more years of its extensive growth. As long ago as 1885 we heard of 2½-watt lamps, and 3½-watt lamps were considered a regular article of commerce. At the Detroit meeting of the National Electric Light Association in 1887 a 1½-watt lamp was described. As no one in the business is advocating longer lives than was claimed ten years ago, it would appear from the figures named above as if the manufacture of incandescent lamps had retrograded and was approaching the state of a lost art.

If the falsity of this supposition were not demonstrated every night one might be pardoned for thinking the industry was disintegrating.

Every investigation of claims for extremely high efficiency has shown that there was some hocus-pocus; either the candle was of the wax taper variety, or the watt was not one of the family that James made famous, or else the lamps didn't live to tell the tale.

Finally people forgot about the 1 watt and the 2-watt lamps, and concluded to take what they could get, which might be anything from three to five watts, depending upon what the maker had ready to send. It really was a matter of small moment whether the lamps were three or five watts per candle, since they all went to five watts the next day after they were placed in circuit.

This state of affairs has continued, with some improvement, until a comparatively recent date. In the meantime elaborate series of life tests were made under the auspices of the Franklin Institute; Mr. W. H. Pierce made an extended test; several foreign tests appeared, and tests were made at the Ohio State University of samples from thirteen different makers. There was nothing promising in the general results of all these tests, and for a time the outlook was rather gloomy. Progress was being made, however, although the results were not published. It was found that lamps whose initial efficiency was less than three watts per candle-power would not last a reasonable time on commercial circuits. This set the maximum limit of efficiency. The minimum was set by what the people would accept, and it was placed at four watts. More recently all energies have been exerted to produce types suitable for the various kinds of uses. We have now the highly efficient central station lamp, the isolated plant lamp and the railway type, besides numberless modifications for special uses.

Among the lamps in the Franklin Institute tests was one Weston tamadine 16-cp lamp that maintained its brilliancy and gave most excellent life. It was the only one of the type, and almost the only one in the test that gave any indication of good quality, as quality is guaged at present. So far as that test went the tamadine lamps were a commercial failure, yet this one lamp showed what might be gotten from a cellulose filament. Since then the cellulose filament has been brought to a degree of perfection far surpassing its prototype. While made by a process differing from Mr. Weston's, the present filaments possess all the good features to be found in this early lamp and have outgrown most of the poor ones. Upon the quality of this cellulose filament I base a claim that the present efficiency of incandescent lamps is better than it ever has been, and is so much better that the lighting industry is to be congratulated.

The incandescent lamp is still a filament of carbon of high resistance hermetically sealed into an exhausted glass globe, with conducting wires passing through the glass. Its quality as an illuminant depends directly upon the quality of the filament and the quality of the vacuum.

The object of the vacuum is threefold:

1. To reduce the energy expended per unit of light emitted, because of the heat lost through convection.
2. To prevent injury to and destruction of the carbon by burning.
3. To prevent injury by abrasion or so-called "air washing."

Any gaseous envelope will carry away the heat energy from an incandescing body so rapidly that a great amount of power must be supplied to maintain its surface at a temperature corresponding to a certain brilliancy, the core being at a far higher temperature. This loss becomes less, as the pressure of the surrounding gas is decreased, until a point is reached beyond which no further changes can be detected. When the vacuum reaches one part in 1000 the loss becomes extremely small, and, after a vacuum of one part in 10,000 is reached, the loss is negligible so far as our present methods of measuring light can determine.

Some years ago we made a series of measurements showing the relation between the degree of vacuum and the power necessary to produce a definite candle-power from a lamp filament. The net results showed that, so far as the convection losses are concerned the degree of exhaustion ordinarily found in incandescent lamps is better than need be.

Carbon at high temperature cannot resist the attacks of oxygen. Therefore all oxygen must be eliminated, even slight traces causing injury to the carbon surface.

We would naturally suppose that the residual gas was composed of oxygen and nitrogen, in the proportions found in air. The induction coil shows that such is not the case, and I believe that in a properly exhausted lamp, although no other gas may be purposely admitted to displace it, no oxygen remains. It is known that a filament will rapidly decline in brilliancy if the vacuum is low, because the radiating surface is injured, but it will not burn out. Very few lamps burn out because of poor vacuum, unless cracked, when, of course, fresh oxygen is constantly admitted.

While the effects of abrasion formerly were considered of importance my experience indicates that at present at least they are of small consequence. A high degree of exhaustion, as measured by a vacuum gauge, is not the object to be attained; an unchanging vacuum is essential to the maintenance of the highest brilliancy. In the type of lamp made five years ago a positive injury resulted if the vacuum were made too high. The disintegration of the filament, due to evaporation of carbon, not only injured its surface, but seriously darkened the bulb.

The vacuum does not grow poorer with age, provided the lamp is properly made and exhausted in the first place. The vacuum changes as the lamp is burned, and a part of the lamp maker's art is to reduce these changes to the smallest degree. But the vacuum is finally higher than at the start. Nothing is tighter than the glass and wire joints of a properly made incandescent lamp. Absolutely no leak can be detected after years. In some lamps used for at least twelve years in rheostats where the current at times brought them to full brilliancy the vacuum was as good as when first made.

Many think that all lamps gradually lose their vacuum. This mistaken notion was caused, no doubt, by a fault common to many individual lamps having the old form of seal at the base, and illustrates the influence which apparently unimportant details exert upon quality as well as the necessity for wide information and extended experience in successfully making lamps.

The present lamps, made by modern methods, have perfect joints or else the leaks are so bad as to be instantly discovered by proper inspection.

* Paper read before the Northwestern Electrical Association, January, 1898.

CONVENTION OF THE NORTHWESTERN ELECTRICAL ASSOCIATION

Milwaukee, Wis., Jan. 19, 20 and 21.

The sixth annual convention of the Northwestern Electrical Association was held at Milwaukee, Wis., in the club rooms of the Hotel Pfister, Wednesday, Thursday and Friday, January 19, 20 and 21, 1898.

FIRST DAY'S PROCEEDINGS.

The convention was called to order January 19, at 11 A. M., by the president, Mr. H. C. Higgins, of Marinette, Wis.

The roll was then called by the secretary.

A motion was made, seconded and unanimously carried that the minutes of the fifth semi-annual convention be accepted as printed.

The president then read his address, a brief abstract of which is as follows:

Mr. Higgins, after greeting his fellow members of the association, spoke of the growth of the electrical business and its rapid extension. He spoke also of the many failures and wrecked enterprises which have marked the progress of electrical development, especially referring to the street railways which were so lavishly installed during the "boom" years of electric railroading. Mr. Higgins said that during the past two years of depression the street railway had suffered not only from a closer looking to the nickels on the part of people generally, but the increasing use of the bicycle had also done much to reduce its gains.

Briefly reviewing the hardships of early years, which taught a useful lesson of experience to street-railway managers, the speaker showed how the admirable patience and persistence which characterized street-railway men had made them masters of the situation at present.

Mr. Higgins then gave the street-railway men present some exceedingly good advice. He said:

"Do not use less than a 60-pound steel T-rail; use good sound ties, not less than 6 inches wide, lay them 2 feet centres (still closer is better); bond with not less than No. 0 bonds; use nothing less than 0 trolley wire; buy nothing larger than 16 to 20-foot cars for general use, and you cannot make much of a mistake by buying the latest type of generators and car equipments from any of the leading companies making and selling such appliances. With such a track and appliances and cars as I have described you will have a very pleasant business, providing your patronage will justify the outlay. Do not, however, lay any extra line in order to establish a park, unless you can establish it on the edge of a body of water, and have a town of not less than 30,000 people to draw from. Do not lay out much money on animals for your park. The park season is short, and the balance of the year in which animals must be fed and cared for is so long that it does not pay to have a zoological department to your park. People very soon tire of looking at animals. Do not run vaudeville or other shows unless you are so situated that their transportation will cost you but little. I believe that street railway parks should be well enclosed, and no one admitted unless they pay car fare each way, no matter whether they come by carriage or bicycle. I do not believe that any town of less than 25,000 people will support an electric street railway and give a decent return to its investors, although a road between two towns aggregating a little less than that population and being some distance apart might be a good paying property, though local conditions would have very much to do with this."

With a few further remarks about the probable future of electric railroading the president brought his address to a close amid much applause.

The secretary and treasurer presented his report, which was unanimously accepted and adopted.

The report showed the association to be in excellent financial condition. Commenting upon the possible joint action of this association and the National Electric Light Association on a report upon municipal ownership to the Bureau of Statistics, at Washington, the secretary suggested the appointment of a representative to attend the next National Association convention. The number of applications for membership on hand was reported to be the largest in the history of the association.

The following programme was presented:

PROGRAMME.

WEDNESDAY—MORNING SESSION.

Convene 10 o'clock—Roll call; readng of minutes; president's address; report of secretary and treasurer; election of officers; elections to membership; reports of committees; unfinished business; new business.

AFTERNOON SESSION.

Convene 2 o'clock.

Paper—"Practice of Theory," by John C. McMynn, of Illinois.

Paper—"Electric Lighting for Profit," by Alex. Dow, of Michigan.

Address—"Topics of Interest to Central Station Men," by Lieut. Francis B. Badt, of Illinois.

7:30 P. M.—Theatre party.

THURSDAY—MORNING SESSION.

Convene 10 o'clock.

Paper—"Long Distance Transmission," by Axel Ekstrom, of New York.

Paper—"The Present Efficiency of Incandescent Lamps," by John E. Randall, of Missouri.

Paper—"Physical and Chemical Properties of Volatile Oils in Boilers," by W. H. Edgar, of Illinois.

AFTERNOON SESSION.

Convene 2 o'clock.

Paper—"Electricity in Municipal Engineering," by Prof. R. B. Owens, of Nebraska.

Paper—"Municipal Socialism," by Fred De Land, of Illionis.

8:30 P. M.—Banquet.

FRIDAY—CLOSING SESSION.

Convene 10 A. M.

BANQUET TOASTS.

"The Badger State," response by Governor Scofield.

"The Cream City," response by City Attorney Van Wyck.

"The Electrical Press," response by Frank L. Perry.

"The National Electric Light Association," response by W. Worth Bean.

"La Crosse and Hospitality," response by F. A. Copeland.

"The Light that Failed," response by H. L. Doherty.

"The Girls We Left Behind Us," response by H. C. Underwood.

"Ourselves," response by W. W. Low.

Adjournment was then taken to 2 P. M., same day and place.

PROCEEDINGS OF THE AFTERNOON SESSION.

The next session was called to order by the president, January 19, at 2:30 P. M.

After the transaction of routine business the following officers were appointed:

President—Mr. F. A. Copeland, of La Crosse, Mich.

First Vice-President—Mr. James R. Dee, of Houghton, Mich.

Second Vice-President—Mr. P. H. Korst, of Racine, Wis.

Secretary and Treasurer—Mr. Thomas R. Mercein, of Milwaukee.

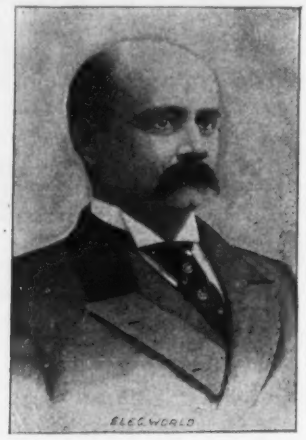
Directors—Mr. E. L. Debell, of Sheboygan, Wis., chairman; George L. Thayer, of Belle Plaine, Ia.; S. B. Livermore, of Winona, Minn.

The new president, on being escorted to the chair and introduced to the meeting, addressed the convention as follows:

I thank you very much. It is an honor to which any member of this association should be proud to aspire; but even large bodies and wise bodies sometimes make mistakes, and I hardly think that

you have chosen the right man to be president of so intelligent an association. If it was an ordinary city council I would know where I was. I would have an entirely different element to deal with. I wish to congratulate the association, however, on the tone that has been kept up since it was started, the acquisition of members, and I have no doubt that if each member does his duty that we will eventually swallow up the national and all the other associations.

I think that our association is doing really more good and is of more benefit to the man actually in the light and power business and dealing with the public than some of these higher and more aristocratic institutions. We come next to the people, and I would like to impress upon the minds of all members the importance of inducing



President F. A. Copeland.

those that are engaged in any way in the electric light business to become members of this association. The paltry sum of $5 ought not to be any stumbling block. We should convince those people who are not with us now, that even if they are not in danger and sailing along all right there may be a time when they will need some help. It is characteristic of human nature to ignore the future when the present is safe, but when they get into trouble they will say: "Why don't you do something for us?" They should get in line and get to work right at the start and help each other. As I understand it, the object of this association is not to antagonize the public or anything of that kind. We are in a legitimate business and we must teach those that we are dealing with, that we are carrying on a legitimate business and will do the best we can, and that all we ask is a fair remuneration for our capital; we will either have that or we will quit.

There is a good deal of work for each member of the association. A member should not sit down, keep still and let the rest do the work. Each one has a certain duty to perform, and if each one will do his duty, we will have one of the grandest organizations there is in the country.

Gentlemen, I thank you very much, and if you will be lenient with me I will try and get through and do the best that I can.

Mr. Pliny Norcross, chairman of the protective committee, then presented the report of that committee:

This consisted mainly of an account of numerous visits made by the committee to the state capital at Madison, and their appearance before the legislature there on behalf of the electric light interests of the State. In Wisconsin there is a tax of 1½ per cent. on the gross incomes of stations and street railways up to incomes of $250,000, and a larger percentage for larger incomes. In many respects this method of taxation is bad, but it is better than the old system, which left the plant at the mercy of an assessor, who could fix its valuation very much as he pleased.

Business details concerning the next semi-annual meeting were then taken up, a proposition being made to secure the elegant steamer Northwest for a special trip from Chicago to Duluth, Minn.

A paper was then read by Mr. Alexander Dow, of Michigan, on the subject of "Electric Lighting for Profit."

This paper may be found in another column.

After a vote of thanks had been extended to Mr. Dow for his able and instructive paper, the following discussion took place:

Mr. Thayer—I would like to ask Mr. Dow one question: In a large number of the smaller plants in towns of from 3000 to 8000 inhabitants, where we find a combination of alternating and direct-current series arcs, how would you recommend one to handle a power load, by the installation of a direct-current plant or going right ahead on alternate current lines?

Mr. Dow—I should say that a person who has such a plant is unfortunate, and that a selling agent or consulting engineer who would recommend such a plant is almost criminal. Now, having got such a plant you are in a hole (laughter) and in a bad hole.

I am at present manager of a direct-current plant, low tension; my power lead is a day load, which is mostly near my plant; the plant was located to be near that power load. It is an old plant that has been running for eleven and a half years. It has made a dividend ever since the first year, and has always kept its property up to its inventory. It has had competition from two direct-current arc plants, selling series arcs and alternating lights, but one of those competitive plants is in the hands of a receiver now, and the other not only has paid no dividend, but has actually asked to be excused from paying its taxes on the ground that it is so hard up.

If you have a plant of that kind you are in the hole. I will not say whether you are to blame for being in that hole, but if you can get after the man who put you in mark him down as not knowing his business, or as being over-anxious to sell you the plant.

How can you get out? I cannot recommend now any general prescription. I do not think that any electric light man should stand up for one system or another under all circumstances, any more than a doctor should stand up for one course of treatment for all diseases. You ought to consider each case and prescribe accordingly, and each thing that has been offered to us—direct series arc, low tension system, alternating—every one has its own place.

There are two good methods of establishing a new plant or reorganizing an old plant, one is the so-called monocyclic system, which is a good system, and you can get arcs to run from it nicely—the new enclosed arcs do nicely on it—and it is for the general class of country towns and attendants a very satisfactory kind of a plant, only do not make the mistake of putting in 2200 volts if a little more copper will let you out with 1100. You will have about three times as much trouble with wires and nine times the trouble with lightning with the higher pressure than you would if you stayed at the lower pressure.

The other plan is open to anybody, there being no patent in force, the 240-volt distribution. It is highly satisfactory. The most unsteady kind of a power load is an elevator, but my station is successfully handling elevators during the daytime 3 miles from the station. Our customers used to say when the lights blinked: "There goes the elevator in the Alhambra Flat"; but in the daytime in the residence district you have surplus lighting and it makes no difference if they do blink. In the night time you cannot get good service on elevators without using a great deal of copper, even with a big booster system; but you can run a sub-station, and we expect some time to make a storage battery station, when they are not so expensive. We give bad lighting in the daytime, but the lighting from dusk to 11 o'clock is very good. If you can tell your customers plainly that the current will be on in the daytime, and that they should take what they get in the daytime and be thankful, and tell them that motors will run steady if the load is steady, they will be satisfied, and you can cover a tremendous amount of territory with your copper; only see that the two loads do not interfere. In most cases they do not interfere. Spend enough money for copper to begin with. That means, of course, no dividends for two or three years, and the man who sells the goods to you should say: "See here, are you willing to see this thing grow up until there is enough business to pay interest on the copper, or do you wish to begin to cash in your chips right away? If you do, you had better try the alternating system; but if you want a profit by and by with a pretty sure thing of it, try the other."

The direct-current system, 220 to 240 volts, has not yet been properly exploited, and I think it is the one that will cover the most small towns that my friend has spoken of. Outside of that is the monocyclic system, which is very satisfactory, and I would speak of it even more freely if it were not a system controlled by one company.

Here the subject of municipal ownership was taken up and followed by routine business, and adjournment until the next day.

PROCEEDINGS OF THE SECOND DAY.

The meeting was called to order January 20, 10:40 A. M., President Copeland in the chair.

After the transaction of routine business, Lieut. Francis A. Badt, of Illinois, made the address abstracted below on the subject of

TOPICS OF INTEREST TO CENTRAL STATION MEN.

Mr. Chairman and Gentlemen—When I reached Milwaukee I found my name on the programme for an address on the subject of

"Topics of Interest to Central Station Men," when I had simply asked for the privilege of saying a few words extemporaneously.

For the last four years I have been one of the many advocates of the straight 220-volt, direct-current system. When we commenced about four years ago to ask lamp manufacturers to make us 220-volt lamps, they all declared it could not be done, saying it was not practicable, would not pay them, and so forth; and we had almost to coerce them into making us 220-volt lamps; but I find to-day, and I feel very good over it, that many manufacturers advertise 220-volt lamps as a specialty. In other words, they have become a commercial article.

A straight 220-volt system is much simpler than the Edison three-wire system, necessitating only one dynamo, doing away with neutral wire, with balancing devices to keep the two sides of the three-wire system at proper voltage, etc., and it is also much more easily managed than a three-wire system. It costs less in installation and maintenance, if proper caustion is used. We have to-day 220-volt incandescent lamps, and within the last few months enclosed arc lamps have been developed by a number of companies, which will burn singly across 220 volts. A 220-volt, direct-current motor has many advantages over a 120-volt motor, so that we may say that in the 220-volt, direct-current system we have a good system for small central stations where moderate distances are to be met, say three-quarters of a mile radius from the station. The 220-volt arc lamp is probably known to many of you. It is a lamp which, at nominal 2000 candle-power, uses two and one-half amperes and consumes about 160 volts in the arc. The arc is three-quarters of an inch long. Of course, the advantage of such a lamp over two or three lamps in series is evident.

In spite of many theoretical demonstrations to the contrary the enclosed arc is the arc of to-day in the United States, and the open arc for constant potential circuits is getting out of vogue entirely. I think that it will not be very long when we will have an enclosed arc of 500 volts to be attached directly across the wires of a railway circuit.

There is another matter that I should like to mention in connection with the enclosed arc lamps, and that is the gas cap, as it is usually called, that is to say, the cover for the inside cylinder through which the upper carbon passes. That gas cap must have an opening through which the carbon passes. Most enclosed arc lamps use what is commercially called a half-inch carbon. I have calipered a few hundred of them, and find that they vary from 25-1000 of an inch below to 25-1000 of an inch above the standard half inch. You can easily see that one of the requirements of an enclosed arc lamp is to have the carbon fit as tightly through the hole as possible, to prevent the outside air from getting into the cylinder. If the carbon is a little too large it will stick; again, if the carbon is too small, too much air will follow into the opening and the lamp will not burn the guaranteed lifetime—150 or 170 hours—whatever it may be.

The different manufacturers of enclosed arc lamps—I think there are about twenty in the United States now—have not adopted the same diameter for the opening of the gas cap. The diameters vary from exactly half an inch to about 18-1000 greater. Taking that in connection with the variations in the diameters of carbons, a man who has a few hundred enclosed lamps, and buys carbons indiscriminately without ascertaining the diameter, may have considerable trouble; and I would suggest that this association take up the subject of standardizing the diameter of the hole in the gas cap, and urge the manufacturers of enclosed arc lamps to adopt one standard.

As to the alternating system, my opinion is that the single-phase system will eventually be the system. It recommends itself for its simplicity, and I think it will not be long now before we have any number of different makes of single-phase motors in the market. We have now, of course, incandescent lamps for alternating currents; we have alternating arc lamps; we have finally gotten a few alternating enclosed arc lamps that give a light of about 100 hours with one trimming of 12-inch carbon, and if we get the single-phase motor, I think we will have the system for stations that cannot avail themselves of the advantages of the direct-current system.

I should like also to draw your attention to the steam engine. You probably are aware of the fact that the best type of modern stationary steam engine only yields us the power equivalent of about 13 per cent. of the energy which we find in good steam coal; in other words, there is 87 per cent. left for improvement. The engine of the future will have a much higher efficiency, of course. It will do away with boilers. It will burn the fuel, either powdered coal dust or oil, in itself. I am not guessing here, but I am just describing an engine which is now on exhibition on the other side of the water. You can all figure out for yourselves what a revolution in steam engineering such an engine would produce.

Mr. W. H. Edgar, of Illinois, then addressed the convention on the subject of

PHYSICAL AND CHEMICAL PROPERTIES OF VOLATILE OILS IN BOILERS.

I have not a written paper, but I will speak on the subject of the use of volatile oils, hydro-carbons, kerosene and oils of that nature in the steam boiler. Our waters are heavily impregnated with lime and magnesia, which are scale-forming salts, forming an incrustation in the steam boiler, which is a poor conductor of heat, as compared with iron, so that we are forced to look around for something to counteract the evil effects of this incrustation and to get rid of it if possible. Among the different reagents employed have been volatile oils. Turpentine and resinous oils have been pumped into boilers up in the lumber districts; and in the oil fields they have been in the habit of pumping kerosene into the steam boiler.

Kerosene is a hydrocarbon. If we had a carbo-hydrate, an animal oil, we would get an oleate radical, and could possibly get the oleate of lime or oleate of magnesia, which, however, would not help us out; but we could get a chemical reaction from a carbo-hydrate, having a combining acid radical there; but in the hydrocarbons we have no possible acid radical; we have not the base; we have not the combination that will take the place of either base or an acid radical, and we get no chemical reaction whatever, and the action of the kerosene is purely mechanical, following the laws of capillary attraction. If I dip a blotter into water, the water will run up the side and penetrate the blotter; if the blotter is set over a tumbler of water the water will penetrate through the substance of the blotter; and if you play a hose on a brick wall the moisture will penetrate to the other side. Kerosene, being a light volatile oil, will penetrate everything of a porous nature, such as lime, magnesia, etc., and will penetrate to a greater extent and more rapidly than water. The scale incrustation in the boiler will be softened, being porous, and the kerosene will work through to the iron and will run back of the sheet of scale, between the scaale incrustation and the iron, and prevent the scale from adhering tightly to the metal. The kerosene does not change the chemical composition of the scale; its action is purely mechanical.

Kerosene volatilizes in the steam boiler; probably a third passes over with the steam; it begins to come over at about 150 degrees Fahr. When a light volatile oil of a hydrocarbon nature is combined with the steam a series of oxidizing hydrocarbon reagents is formed that will intensify the general pitting and grooving and eating of the threads and other parts of the steam system 100 per cent.; that is, there will be a general eating through of the joints and connections probably twice as great as with pure steam.

The kerosene in the cylinders dilutes the lubricating oil, and has a tendency to change its properties. It also causes a blackening of the piston rods and a general oxidizing effect on the packing rings. The part that goes through the scale and reaches the iron is carbonized by the high heat, and tends to carbonize the iron. All the scale is not removed with kerosene; those who use it simply look at the scale taken out and do not look in the boiler to see what is left. It takes several years to scale a new boiler on a fairly good water, but if it is scaled once it will scale again in three months, because the skin of the iron is gone, and the scaling ingredients readily attach themselves to the rougher iron.

In the discussion which followed Mr. Edgar gave the following further information:

The action on the iron is purely an oxidation with the aid of hydrogen. In the submerged part of the boiler there is a pitting and grooving of the iron, and in these pits there is a scab, or the appearance of one. If that is knocked off there will be found underneath it a little hole eating through the skin of the iron, and in that hole is a red powder, which is ferric hydrate.

The carbonates of lime and magnesia may be converted into tannates by vegetable compounds, and the sulphates may be changed to saccharates by the action of sugar. Tannins in the extracted form and blended with sugar give no tannic reaction. The tannins will take up lime and magnesia, but it is impossible to get any effect on the iron or metal. They also have no effect on the gaskets or any

of the substances of an organic nature in the packing. Using a vegetable mixture of that kind will keep the gaskets pliable. All the connections of the boiler plant will remain intact, with no leaks, and the boiler will be clean. It is well always to mix in a little slippery elm and poke root or powdered willow hardwood pulp so as to get a little soluble wood starch, thus keeping the sugar from being too stable and the tannins likewise, so as to get readily convertible tannates and saccharates.

A surface blow-off contrivance is very good, but the trouble with such things is that they are expected to do all the work, and sufficient interest and care is not usually taken in their application by the engineer. The boiler is too often neglected, and it cannot get up and speak its piece like the engine, when anything is wrong.

Do not forget to treat the boiler regularly. Put in whatever you use regularly. Have the water analyzed, and go to the wholesale druggist and he can mix up the tannins and sugars in proper proportions; but do not use any soda. Some sulphate waters require considerable starch, slippery elm, etc.; they sometimes use 5 or 6 per cent. of carbonate of soda, boiling it; that goes to kill the gelatinous properties, and then when you introduce your tannin extract the soda produces tannates of soda, 5 per cent. tannate of soda, 20 per cent. of sugar and 50 per cent. of tannins. The steam users in the country should look into this thing and should study their boilers.

The greatest point in regard to compounds is the care given to the boiler.

Mr. De Land then read a paper written by Mr. John C. McMynn, of Illinois, on the subject of "Practice of Theory." A short abstract of this paper will be found in another column.

A paper was then presented on the subject of "Present Efficiency of Incandescent Lamps," by Mr. John E. Randall, of Missouri. The first installment of this paper will be found in another column.

A recess was then taken until 2 P. M., same day.

AFTERNOON SESSION.

A paper on this subject, "Electricity in Municipal Engineering," by Prof. R. B. Owens, of Nebraska, was read by the secretary. This paper will be found in another column.

A paper on the subject of "Municipal Socialism" was then read by Mr. Fred De Land, of Illinois.

Mr. De Land's paper consisted of an account of the circumstances connected with the letting of a contract for the building of a plant at Des Moines, Ia. It appears that in that city there were three electric light plants, one of which the city unsuccessfully tried to buy. When, after this, a contract had been prepared for the construction of a plant and was ready for signature an injunction was served upon the city authorities restraining them from entering into such a contract, and the whole matter was thrown into court, where it now is.

Meanwhile, the city contracts for lighting having expired, the mayor, by virtue of an old ordinance, ruled that the city would thereafter pay only $75 per year for 2000-cp arc lamps, burning all night and every night. Mr. De Land held that this price was a great injustice to the lighting companies. He cited the records of the municipal plants at Detroit, Topeka and Allegheny City, to show that the average cost of such arcs furnished by these plants is $85 per year. He strongly protested against the methods of the authorities of Des Moines, and said that such actions were the beginnings of a municipal socialism, whose propaganda were being preached for the benefit of politics and politicians.

The discussion following this paper was long and enthusiastic, and showed that the members of the association were largely in sympathy with Mr. De Land. Many figures were quoted and facts cited to show the generally false character of the reports of municipal plant service. Messrs. Bean, Thayer, Pierce, Thorp, Debell, Jackson, Trott, Doherty, Livermore, Norcross, Ralph, Dee and De Land took part in the discussion and expressed their views on the subject.

The convention then went into executive session.

At 10 A. M., January 21, the convention was called to order, and after the transaction of routine business, adjourned *sine die*.

Demand for Calcium Carbide.

In a review of the past year given by the *Progressive Age* it is stated that the demand for this material is far in excess of the supply, and that plans are now maturing for the construction of an enormous plant to utilize 100,000 horse-power, entirely for the production of calcium carbide.

The Practice of Theory.*

BY J. C. M'MYNN.

The subject of this short paper remainds me of a trolley car, for the reason that it can be turned either way and runs equally well. Whether the subject should be the "Practice of Theory" or the "Theory of Practice," I must leave for your judgment.

To a certain extent we are all theorists, for we have our own original ideas and fancies, and often the engineer who prides himself on being a practical man is the most theoretical.

However, it is with regret that I notice that the old-fashioned engine driver is fast disappearing. How he could sneer at and deride "book-learning" and "book-foolishness," but he deserves our respect and admiration for the success he attained and the hard work he expended happily, but unnecessarily. He knew nothing of the B. T. U. in his coal, nor of entrained moisture in his steam, nor of the hyperbolic curve in his engine, but he managed to keep his engine and plant going, and to still have time to ridicule "book-learning."

We have also met the theoretical engineer or college boy who could calculate the thermal efficiency of an entire plant from the coal pile to the incandescent lamp, but who could not start a Corliss engine and who would be worthless in an emergency.

Neither of those men fills our ideal, but a proper combination between the two will give us an able, earnest, thoughtful and cautious engineer. Engineering colleges are turning out, year after year, educated engineers who are exerting a strong influence on the profession, which is resulting in a close union of practice and theory, the outcome of which must necessarily be engineers of a high standard, with broader and deeper foundations of learning and experience.

In my idea the application of theory to practical work is of the utmost importance to every owner of steam and electrical machinery. In construction work as well as in operation, it is most valuable. To be sure, an engineer can consult a text or hand book, and can there find out that masonry will sustain certain loads, or that a girder of given dimensions will support a certain weight, but if he is unable to understand "the how" and "the why" he is much more liable to make an error. One may read that phosphorus is detrimental to boiler and other steel, but if the reason is not clear can one appreciate the danger arising from its presence?

To a certain extent the manufacturer represents the practical side of engineering, while the inventor and consulting engineer represent the theoretical side; yet frequently the manufacturer sees the advantage of praticing theory, and in such cases we see experimental laboratories established in large plants and original research carried on under the supervision of the most competent theorists.

Nearly every modern machine is an example of practical application to mechanics and design of theoretical ideas and discoveries, which thus become mechanical laws. Men knew that the electric current would some day become of commercial value, and long before the perfected dynamo appeared the laws governing the generation of the current were known.

In a certain way theory is the foundation and practice the structure of an engineer's attainments. The deeper and more substantial the foundation the higher and more imposing can be the superstructure; the more substantial the foundation, the more resistance will the structure have to either the winds of adversity or the more dangerous gusts of flattery and adulation.

"Zeitschrift für Elektrotechnik."

Our Viennese contemporary, which was formerly published twice a month in magazine size, has with the beginning of this year become a weekly, and has enlarged its size to that which now appears to be the coming standard size. It is the official organ of the Electrotechnical Society of Vienna. Mr. Kareis, who has been the editor for the past fifteen years, has resigned and been succeeded by Dr. Sahulka, who is well known in the electrical fraternity, and who was the Austrian member of the International Electrical Congress in Chicago in 1893. The style of the paper has been greatly improved.

* Extracts from a paper read before the Northwestern Electrical Association, January, 1898.

Digest of Current Electrical Literature

American and Foreign.

by Carl Hering.

A slight change in the typography of the Digest has been made, commencing with this issue, in order to adapt it better to the exigencies of machine composition. The titles of the paragraphs and the names of the authors will hereafter appear in capitals, displacing the italics formerly used, a change which will not only add to the appearance of the columns, but also somewhat facilitate reference to the Digest by reason of the greater distinction given the title lines.

DYNAMOS, MOTORS AND TRANSFORMERS.

TRANSFORMING TRIPHASE INTO SINGLE PHASE CURRENTS. Lefevre. "L'Ind. Elec.," Jan. 10.—A short article in which he discusses briefly the Schuckert system, in which an iron ring has six primary coils and an iron bridge piece crossing it in the direction of a diameter and provided with a secondary winding; the three primary currents in the six coils produce a revolving field and this produces an oscillating field in the single secondary coil on the bridge piece. Grassi has shown that the three primary currents will be altered by the presence of this bridge piece, which destroys the symmetry of the apparatus; they do unequal work and the impedance is much larger in one of them while the other two absorb a large quantity of energy, even when the secondary is open; on closed circuit practically only one coil acts usefully; the efficiency is therefore quite low, being less than 20 per cent., and the voltage diminishes rapidly with the load. To overcome these disadvantages Grassi and Civita constructed an apparatus in which the three primary currents act in three distinct coils, "the windings of which are united into a single circuit;" the three cores are parallel and united by cross pieces, each core carrying two coils, a primary and a secondary; the three secondaries are connected in series, but the direction of the third should be opposite to that of the first, while for the middle one the direction is a matter of indifference. It is an advantage to increase the diameter of the wire of one of the coils as the energy on open circuit is then smaller; the efficiency is high and comparable with that of ordinary transformers, and the voltage varies but slightly. (The description of the latter modification is not quite clear.)

DESIGN OF A SHUNT MOTOR. Zingler. Lond. "Elec. Rev.," Jan. 7.—The beginning of an article in which he endeavors to show how a dynamo may be calculated from first principles, the reader being supposed to be familiar with dynamo design as described in text-books. The type which he selects is an ordinary two-pole inverted shunt dynamo with a drum armature, which type he believes is used more frequently than any other; the armature is built up of round discs, the wires being keyed on with wooden pegs; the bars are built up of copper strips placed edgewise; he gives the figures which are used in actual practice for the various thicknesses of the insulation; he assumes that there are no other data at hand by which this machine can be approximated from others; "dynamos of any one type are rated by the number of watts per revolution, and it is found in practice that, after taking a certain diameter of armature, a machine can be built round this up to a limited number of watts per revolution only—that is, after the armature has become twice the length of its diameter" or after the current has become so great that the number of commutator bars becomes less than 40; he assume an output of 400 amperes and 80 volts at 320 revolutions, which is 100 watts per revolution. He then calculates the size of the armature, using the usual formula and assuming 120 commutator bars; from the number of lines of force and an assumed induction of 10,000 lines per sq. cm. he obtains the cross-section of the armature and that it is very little longer than its diameter; he then begins the discussion of the calculation of the proper winding.

RESEARCHES WITH PHASE TRANSFORMERS. Lombardi. "L'Eclairage Elec.," Jan. 1.—A long abstract in French of the paper, a German translation of which was noticed in the *Digest*, Dec. 11 and 25.

LIGHTS AND LIGHTING.

NEW METHOD OF PRODUCING LIGHT. J. B. "L'Elec.," Jan. 1.—A short article in which it is stated that by means of electricity the light from a gas jet may be greatly intensified; if for instance a platinum net is placed in the centre of a gas flame and a current passed through it the intensity of the light will be enormously increased, the light being brighter and developing less heat; the current required is said to be quite small, several primary batteries or one or two accumulators being sufficient to increase the intensity of the ordinary gas flame five times with half the consumption of gas; it appears that as the light is increased the heating power of the flame is diminished.

SWITCH FOR SUSPENDED ARC LAMPS. "Elek. Zeit.," Jan. 6.—An illustrated description of a switch contained in a rosette directly above the suspended lamp, which is opened by lowering the lamp and closed again when the lamp is drawn into place; the chief object is to obviate the use of the unsightly leads, which may then be placed entirely out of sight.

AUTOMATIC ARC LIGHT SWITCH. Lond. "Elec. Eng.," Jan. 7.—A brief illustrated description of the Edmunds switch, whose object is "apart from the usual and obvious one" to substitute incandescent for arc lights and the reverse for public lighting, also to substitute these in case the lamp mechanism fails to act, and finally to extinguish the incandescence.

ACTION OF ALTERNATING ENCLOSED ARCS. Fraley. "Elec. Eng.," Jan. 20.—A communication criticising the article by Baker in THE ELECTRICAL WORLD, Dec. 11, on tests of such lamps. He contradicts a number of the statements, stating that a number of things which Baker says cannot be done are quite possible if one knows how to do it. It is perfectly possible to use solid carbons for both with no greater tendency to extinguishment than with cored carbons and even with better results; the flaming effect takes place equally and as frequently with cored as with solid carbons; lamps can be made to run equally well on all frequencies from 7000 to 16,000 without any change. He intimates that these matters are kept secret by those who understand them.

POWER.

THURY SERIES SYSTEM OF TRANSMISSION WITH CONTINUOUS CURRENT. Weishofer. "Zeit. Fuer Elek.," Jan. 2.—A reprint of an illustrated paper read before the Electrical Society of Vienna describing this system, which is in use in a number of installations. The dynamos are connected in series as are also the motors; the various safety devices required are illustrated and described.

DUST DESTRUCTORS. Lond. "Elec. Rev.," Jan. 7.—A communication by Whitcher and another by Kershaw continuing the discussion which has been going on in that journal.

ENGINES FOR ELECTRIC RAILWAY POWER STATIONS. Emery. "St. Ry. Jour.," Jan.—The second of his articles on the best practice in the United States for the construction of engines designed to meet the variable loads experienced in electric railway service.

ELECTRIC POWER IN SEWER CONSTRUCTION. "Elec. Eng.," Jan. 13.—A brief illustrated description of the electrical devices used in building a sewer at Worcester, Mass.; six scows are driven electrically through the large sewer, the double trolley system being used; the sewer is lighted by electricity; ventilating fans and pumps are operated electrically.

RATING ELECTRIC POWER PLANTS ON THE HEAT UNIT STANDARD. Aldrich. "St. Ry. Jour.," Jan.—An addendum to his recent paper. The method of rating is applied to the station tests included in the 1897 report of the Nat. El. Light Asso., showing the kw-hour output per 1,000,000 B. T. U.

ELECTRICAL STEERING GEAR. "Elec. Eng.," Jan. 13.—An illustrated description of the Pfatischer gear, in which he has retained the method of steering that has been followed for years.

TRACTION.

RAILWAY STATISTICS FOR GERMANY. "Elek. Zeit.," Jan. 6.—A very long table of statistics covering twelve pages of that journal. They are limited to the railways in public use and do not include those in mines or factories; the twelve columns of data refer to the construction, as distinguished from the operation, of the roads; the statistics are up to Sept. 1 of last year and cover a period of the previous thirteen months, during which time there has been very great activity in the introduction of electric railways in Germany. Some general conclusions are given in the long leading editorial. During the present year in some of the largest cities in Germany, namely, Berlin, Frankfort-on-the-Main, Cologne, Koenigsberg and Munich, the horse cars will be replaced entirely by electric railways, while in several other cities, like Dresden, Hamburg, Hanover and Leipsic, this change will be nearly completed during the present year. Electric railways exist in fifty-six of the cities in Germany or up to Jan. 1 in sixty-four; the length of track on Sept. 1 was 1356 km., which is an increase of 58.7 per cent. during the preceding thirteen months; the power at the generators is 24,920 kw., an increase of 34.3 per cent.; up to Jan. 1 the length is about 1500 km., which would reach from the most northern to the most southern portion of Germany. Accumulators have lately been added in quite a number of cases, in parallel with the generators. The average number of kw. per km. of track is 21.7 as compared with 25.6 in the previous year; the average number of kw. per motor car is 14.6 as compared with 15 for the previous year; both these figures show a better utilization of the machinery. The systems are almost exclusively overhead, there being only a few short stretches in Berlin and Dresden where the conduit system is used; the accumulator system is used in eight cities; the mixed accumulator and overhead system is used on a short line in Dresden and on a large scale in Hanover and it is about to be used in Berlin.

ACCUMULATOR TRACTION. Kennedy. Lond. "Elec. Rev.," Jan. 7.—A very short article calling attention to the omission in the one by Ayrton (see *Digest*, Jan. 8), of the figure giving the rate of discharge per pound of plates at which those figures were obtained; he shows how the absence of this figure might enable the data to be used for other purposes for which it was not intended. He urges that electrical engineers should agree on some orderly method of tabulating battery performances, as at present there is complete chaos; the watt hours discharged per pound should always be given, with the rate of discharge per pound, and the cells compared must be of nearly the same rate of discharge; if these figures are omitted the data is valueless for comparative purposes.

CONTACT PLOW FOR CONDUIT LINES. Lond. "Elec. Eng.," Jan. 7.—A brief illustrated description of a new form recently patented by the Union Co. in Berlin. It is so constructed that it is automatically lifted out of the conduit in the event of the slot being obstructed by any foreign substance.

BRUSSELS. "L'Elec.," Jan. 1.—A very brief description of the railway systems in that city.

POSSIBILITIES OF STREET RAILROAD DEVELOPMENT IN EUROPE. "St. Ry. Jour.," International Edition, Jan.—The first of a series of articles in which will be described the conditions bearing on tramway operation and development in the different countries of Europe. The differences between American and European railroad and street railway facilities are described at considerable length, and lists are given of the principal cities in each country, with information concerning the mileage of tramways and motive power in each city. The present paper deals with Europe in general, and the countries of Great Britain, Germany and Belgium in particular. It is shown, among other things, that while Europe has a population nearly six times greater than that of the United States contained in about the same area, America has one mile of steam railroad for every 343 inhabitants, while Europe has but one mile for every 2500 inhabitants. America has but fifty cities of over 50,000 inhabitants, while Europe has 279; nevertheless, in America are found 15,000 miles of street railway track, as against 9000 in Europe; in the British Isles are found one mile of railroad for every 1800 inhabitants, and one mile of tramways for every 39,000 inhabitants; in eight American states of the same area as the British Isles are found one mile of railroad for 666 inhabitants, and one mile of tramway for every 2400 inhabitants. Germany has one mile of railroad for every 1850 inhabitants, and eleven American states of the same area have one mile for every 585 inhabitants, although the population density of the eleven American states is far less than that of Germany. Belgium, the most thickly populated country in the world, has 862 miles of street railway and "light" railway track, while two American states of the same area—Massachusetts and Connecticut—have 1736 miles exclusive of steam railroads proper.

CHANGING A CABLE TO AN ELECTRIC CONDUIT. "St. Ry. Jour.," Jan.—The Capital Traction Company, of Washington, D. C., is changing its cable railroad to a conduit electric railway; the power station will contain 800-hp tandem compound engines, and three 100-kw boosters; the most interesting portion of the installation is the change required in the conduit. The installation of the conductors was a comparatively easy undertaking, but as the conduit did not possess any means of protecting the conductors from the drip from the street, it was decided to equip the slot rails for the entire length with a 1-inch angle-iron, riveted to the edge of the slot rail; the rivet holes are located in each end of the slot rails; all drilling and riveting had to be done from the surface of the street, and the apparatus for this is described; the conductors are of T-shape, and weigh about 211 pounds to the yard; the insulators are similar to those employed by the Metropolitan Railroad Co., of Washington, and the Metropolitan St. Ry. Co., of New York.

STORAGE BATTERIES AS STATION AUXILIARIES. "St. Ry. Jour.," Jan.—The Consolidated Traction Co., of Pittsburg, has recently installed two sets of storage batteries as station auxiliaries, one in one of its power stations, and the other at a point midway between the other three power stations; each set has a capacity of 500 ampere hours. The result has been a considerable increase in the output of the stations; in a particular instance one set of accumulators in parallel with a 800-kw generator, has enabled the company to obtain from this generator continuously for twenty-four hours an output of 1100 kw. The total output of the four stations can be easily adjusted by means of accumulators, so that any one can be made to carry any portion of the load up to its capacity, the four stations are tied together by feeders; the actual economy in the resistance loss in the feeders by maintaining the voltage constant is very large. The results secured on this line have been so important that the United Traction Co. has decided to abandon its present McKeesport station and substitute for it a storage battery station; the maintenance of this station has cost the company, on an average, about $7200 per annum, most of which, it is thought, will be saved by the installation proposed.

REPAIR OF RAILWAY MOTORS. McAdoo. "St. Ry. Jour.," Jan.—He describes a new method of testing motors without any disconnection or dismounting of the equipment, except that of removing the cover of the controller and the ground connections. The method shows all poor connections in the wiring, controllers, rheostats, fields or armatures, the temperature of the motor, whether the motors are equalized, etc. The method of testing the armature is described in detail; it is the Thompson method, in which a current is carried through a resistance rheostat and the armature, and a drop is taken from this rheostat such that it will balance the drop through a coil of the armature; the latter is then revolved and a poor connection with a segment of any lead, or low resistance in any section of the armature can be easily located.

ELECTRIC RAILWAY MOTORS. Hanchett. "St. Ry. Jour.," Jan.—A serial discussing motor suspension; the different methods employed are illustrated and described, and a new method, by which not only the motor, but the wheels, are spring supported on the track, is suggested.

PROPOSED NEW YORK UNDERGROUND LINE. "Elec. Eng.," Jan. 20.—Extracts from information furnished by the General Electric Co. to the chief engineer of the Rapid Transit Commission, concerning the cost of the electrical apparatus for the proposed road.

ORIGIN OF THE MIXED SYSTEM OF ELECTRIC TRACTION. Ries. "St. Ry. Jour.," Jan.—A letter claiming that he is the originator of the method of operating street cars by means of accumulators jointly with the overhead system, a method employed in Hanover and elsewhere in Germany.

RAILWAY BONDING. Harrington. "Jour. Frank. Inst.," Jan., and "El'ty," Jan. 19.—A reprint of the short paper without the discussion, which was abstracted in the *Digest*, Dec. 25.

CORK. "St. Ry. Jour.," Jan.—A description of a new line in course of construction at Cork. The line has a length of about 11 miles and a gauge of 3 feet. The station will contain three tandem compound engines, each directly connected to a 200-kw generator; also a storage battery regulator, consisting of 256 Tudor elements, with a capacity for 770 ampere hours.

CLONTARF. "St. Ry. Jour.," Jan.—A description of the extension, recently started near Dublin, and noticed in the *Digest*, Jan. 15 and 22. The power station contains three tandem compound engines, each directly connected to a 150-kw generator; double-deck cars, with side trolleys, are used.

CHICAGO. "West. Elec.," Jan. 15.—Extracts from the reports of several of the street railway companies of that city which held their annual meetings recently.

BROOKLYN BRIDGE. "St. Ry. Jour.," Jan.—The loop system adopted at the New York terminal of the Brooklyn Bridge for the surface railways of Brooklyn, is described in detail and illustrated from the engineer's drawings.

HEILMANN LOCOMOTIVE. Bayley. "Elec. Eng.," Jan. 20.—An illustrated description.

INSTALLATIONS, SYSTEMS AND APPLIANCES.

CENTRAL STATION STATISTICS FOR THE UNITED KINGDOM.—Lond. "Elec.," Jan. 17.—A supplement in the form of a large folded table, giving well filled columns of data for the central stations in London and the provinces; also for those in progress. In the journal itself some summaries are given in the form of curves and data. The lamp connection diagrams show the rate of increase of the London companies and the municipal stations since 1890, showing a very flourishing condition of affairs. Another diagram shows that the provinces are increasing their lamp connections still faster than London. The table for the United Kingdom is nearly 4,000,000 lamps of 8 candle-power, or their equivalent, and this does not include the private stations. The lamp connections for stations using only the continuous current are considerably greater than for those using only the alternating current, yet there is probably more alternating current used, as the majority of the mixed stations only recently adopted the continuous current for special purposes. Another diagram shows the relation between the municipal stations and those owned by companies, showing that in the provinces the former are much more numerous, while in London they are almost entirely owned by companies; for London and the provinces together those owned by companies are in excess, the unit of measurement being thenumber of lamps. This is followed by a list of applications for stations and railways, also by another list of new public companies connected with the electrical industries and registered during the past year, with their capital; another list gives those which were wound up and dissolved. The list of proposed lighting stations is also given in the Lond. "Elec. Rev." and "Elec. Eng.," with more of the information.

ELECTRIC LIGHT COMPANIES' SHARES.—Lond. "Elec. Eng.," Jan. 7.—A diagram with a brief description showing the fluctuation of the shares of the London stations for the past two and a half years.

PARALLEL OR SEPARATE FEEDERS FOR ALTERNATING CURRENT CIRCUITS.—Lond. "Elec. Eng.," Jan. 7.—Several answers to the question what the advantages and disadvantages are of having the feeders all in parallel, or having an machine for each feeder. Most of these advantages and disadvantages are already known; all of the answers favor the parallel system, which is the usual English practice.

HOSPITAL PLANT.—Lond. "Elec. Eng.," Jan. 7.—An illustrated description of the plant at the Western Infirmary at Glasgow.

GAS PLANT. Loubat. "L'Elec.," Jan. 1.—A well illustrated description of the Charon gas engine and of the plant at the French National Printing Office, where it is used for electric lighting.

MECHANICAL STOKERS IN CENTRAL STATIONS.—Lond. "Elec. Eng.," Jan. 7.—The advantages and disadvantages are discussed.

CHARGING FOR ELECTRICAL ENERGY. Barstow. "Elec. Eng.," Jan. 13.—An article in which he shows how the charges for a system of double-rate metering should be determined, then explains what he considers the best system; this system appears to be merely the well-known one in which the meter is made to read differently during different times in the day; it affords a uniform tariff to all customers, and will improve the load factor; it is easily understood and appreciated by the public, and is based on a proper apportioning to each customer his just share of the expenses of manufacture. He divides the expenses under fixed charges and operating expenses; each customer should pay his proper proportion of each. He then takes the average load curve of a central station for a year, and from this he works out a corresponding cost curve which will show the variations in the cost of a single unit in accordance with its position in the curve; the daily fixed expenses are apportioned to each unit of machinery operating; the load diagram is then divided into blocks, each having for its height "a distance measured by the minimum load of the station," and for its base a distance equal to the time of stopping and starting the unit for the load it takes care of; thus for the units that are working during the whole twenty-four hours the fixed expenses will be divided by twenty-four, and will therefore be low, while for those units which are only used during a few hours the fixed expenses will be divided by those few hours, and will therefore be considerably higher. These fixed hourly expenses are then plotted like a load diagram, the resulting curve showing the fixed expenses per unit throughout the twenty-four hours in accordance with their position on the load diagram; to these are then added the operating expenses per unit, the result showing what amount the company should pay to cover operating and fixed expenses. He then shows what will happen if the load factor of the station improves; as the minimum load increases the expense lines fall gradually to the lowest one, until with a load factor of 100 the expense per unit for the entire day will be equal to the minimum. He then divides the day into two parts, for which different rates are to be charged; for carrying this out he uses the well-known Kapp meter device, which consists of a self-winding clock throwing the shunt in and out of action at predetermined times. When such a system is introduced there will be many customers whose bills will be increased, and therefore he recommends the gradual introduction for these cases. For the benefit of the large consumer additional discounts on the total bills may then be allowed.

MULTIPLE RATE METERING. Oxley. "West. Elec.," Jan. 115.—A short article supplementary to the one abstracted in the *Digest*, Jan. 22, it is written in reply to a number of questions which the first article has suggested. These seem to relate chiefly to the question of applying this system when the circuits themselves are grounded; he describes an auxiliary apparatus, by means of which this difficulty is claimed to be entirely removed. Where a ground circuit is used, an accidental ground at any point may operate every controller of the meters, after which the registration of the meter will be at the wrong rate; the apparatus to prevent this is somewhat similar to his controller, and is placed at the central station; it operates to restore all of the controllers to their original position when they have been accidentally actuated by a ground connection; an advantage is also gained by winding the controller switches for 200 volts, as a ground can give rise to only 100 volts, which is too little to operate the magnets.

MUNICIPAL PLANT AT DETROIT. Fisher. "Elec. Eng.," Jan. 13.—An unfavorable criticism of the recent article by Fitz-Gerald (see *Digest*, Jan. 8); the present writer favors municipal lighting under certain conditions, and defends this municipal plant, which he considers the finest in the country.

NEW ORLEANS.—"Elec. Eng.," Jan. 20.—A long, illustrated description of the new Edison station in that city.

PRIVATE PLANT.—"West. Elec.," Jan. 15.—A brief illustrated description of the plant in the hospital of the Alexian Brothers in Chicago.

PRIVATE PLANT.—"Can. Elec. News," Jan.—A brief illustrated description of the one at the Foresters' Temple, Toronto, which is thought to be the largest isolated lighting plant installed in an office building in that country.

ELECTRO-PHYSICS AND MAGNETISM.

CALCULATION OF THE ELECTRIC RESISTANCE OF ALLOYS. Liebenow. "Elek. Zeit.," Jan. 6.—A reprint of a long paper read before the Electrical Society. After showing how variable the properties of alloys are and the impossibility of fixing their properties by the chemical composition, he expresses the belief that the best way to classify them is by their electrical conductivity, which changes most with different proportions in the alloys, and this he then discusses at great length, endeavoring to show how the resistance may be calculated; he bases his ideas on the molecular hypothesis, which he shows will suffice, with the aid of some known empirical laws, to determine algebraically the increase of resistance. If when two metals are melted together these moleclues remain the same, there will merely be a physical mixture, but if the atoms combine it will form a composite metal. If a current is sent through an alloy the well-known Peltier effect will be produced; in the pure metals the Thomson effect will be produced; on these he bases his theory for the details of which he refers to his former article on the resistance of metals, which appeared in the "Zeit. f. Elektrochemie" (see *Digest*, Dec. 4). He then limits himself to alloys and endeavors to show that his law can be proved from Matthiessen's researches with the resistance of alloys; this he proceeds to do with the aid of curves. Among other things he gives a simple equation from which the temperature coefficient can be calculated approximately He also states that if zinc is deposited on platinum it cannot be dissolved, as is possible with copper, showing that the zinc has combined chemically with the platinum. He also remarks that he has reasons for believing that a mixture of copper, tungsten and lead exists, which in some respects has the properties of platinum. If all possible combinations of the metals could be examined he thinks that it would be possible to find one which conducts even better than copper or silver. He thinks his method of calculating the resistances would aid greatly in such researches.

COUNTER E. M. F. IN THE ARC. Fleming. Lond. "Elec.," Jan. 7.—A communication, in which he points out that there is a possibly source of counter E. M. F in the arc, which has generally been overlooked; in a thermo couple the voltage is due not merely to the Peltier effect, but also to the Thomson effect in the body of the metals. Referring to a paper by him and Dewar in the "Phil. Mag.," July, 1895, he shows from a thermo-electric curve of carbon that the sign of the Thomson effect in carbon is the same as that of copper, but the coefficient has a much greater value; if it keeps its sign at much higher temperatures, and if carbon vapor has a Thomson effect, then there may be in this effect a possible cause for the true counter E. M. F. in the arc; the unequally heated column of carbon vapor may, perhaps, behave like an unequally heated copper rod, and possess an internal E. M. F., due to a true Thomson effect, and it would be against the external E. M. F. The experimental work on this point is not yet decisive, but the trend of the evidence is toward the proof of some internal counter E. M. F.

THE COHERER AND INTERFEROMETER IN THE STUDY OF ELECTRIC WAVES. Hull. Lond. "Elec., Jan. 7.—An abstract of two recent articles, in the first of which he gives the results of researches with the interferometer constructed for the analysis of electric waves. In the second he describes researches with coherers; he found that a coherer formed of about a dozen steel spheres in a glass tube was found to be very sensitive and much more so than one containing iron tacks 1 cm. long, in heavy paraffin oil, although the latter was far more constant, and came back accurately to zero after tapping; the more viscous the medium the less lasting is the change of resistance and the less liable are the nails to be disturbed by the tapping; the medium which will allow the change of resistance to be permanent and yet sufficiently viscous that the nails are not disturbed by the tapping, and that after tapping returns to zero, is the one required for a quantitative receiver; a mixture of vaseline and lubricating oil was found to serve the purpose fairly well.

VALVE ACTION IN DISCHARGE TUBES. Hagenbach. "Wied. Ann.," No. 13; abstracted, with the illustration, in the Lond. "Elec.," Jan. 7.—He examined the curious relation between discharge from points and discs at various pressures, and which has been termed a valve action, as it can be used for separating discharges in opposite directions. The apparatus consists of a vacuum tube with a disc and a point, as the two electrodes; the current can be sent in either direction. When the disc was the anode the current increased until the pressure was reduced to 10 mm., with a minimum point at 0.08 mm., beyond which there was a slight increase, which was probably connected with the generation of X-rays; when the point was the anode the maximum occurred at 2.68 mm., the current being then over twice as strong as in the reverse direction; at very low pressures, however, the current was five times stronger with the point cathode than with the disc cathode.

DAMPING OF DIELECTRICS. Duane and Stewart. "L'Eclairage Elec.," Jan. 1; abstracted from the "Wied. Ann.," 61, p. 436.—Duane in previous researches had found a damping action produced by a magnetic field on the rotation of dielectrics, but the results have not been confirmed, and it now appears from the researches described in this article that the damping action was due to traces of metallic iron in the dielectric.

THE TWO CONDUCTIVITIES. Schulze. "Wied. Ann.," No. 13; abstracted briefly in the Lond. "Elec.," Jan. 7.—He investigated the ratio between the thermal and the electric conductivities in various forms of iron rods; in a number of metals this ratio is practically constant, but not so with iron; the ratios for iron varied, but he could not discover the law of the variation, nor could he detect any general connection between the coercive forces and the conductivity ratio.

APPLICATION OF VECTOR ALGEBRA TO ALTERNATING CURRENT. Rhodes. Lond. "Elec. Rev.," Jan 7.—The beginning of an article which is in the nature of a treatise on this subject; it appears to be written in an easily understood style, most of the mathematics in it being comparatively simple.

ZEEMAN EFFECT. Cornu. "Jour. de Physique," Dec.; abstracted in Lond. "Elec.," Jan. 7.—He devised a new arrangement which shows the effect with sharp definition, and removes all doubt from the conclusions arrived at by Zeeman. His purely kinematical interpretation brings out clearly the lifference between the Zeeman and the Faraday effects.

MECHANISM OF THE FARADAY EFFECT. Broca. "Jour. de Physique," Dec.; noticed briefly in the Lond. "Elec.," Jan. 7.—Cornu showed that luminous rays suffer no influence from a magnetic field, unless that field acts directly on its source; Broca made some tests to show whether the energy of the ray is affected, and obtained negative results; there is therefore no absorption of energy discernible in the Faraday effect.

TORSION AND MAGNETISM. Drude. "Wied. Ann.," No. 13; noticed briefly in the Lond. "Elec.," Jan. 7.—He investigated the rival theories to explain the connection between the mechanical deformation and the magnetic qualities of iron and nickel wires, and finds that the change in the permeabilities in different directions under longitudinal strains is not sufficient, since the change in the permeability depends on two constants.

EXTERNAL FIELD OF MAGNETIZING RINGS. Mordey. Lond. "Elec. Rev.," Jan. 7.—A reprint of the short article noticed in the *Digest*, Dec. 25.

HIGH E. M. F. Trowbridge. "Sc. Am.," Jan 15.—A short article describing his high voltage battery and experiments; a short article referring to these was noticed in the *Digest*, Jan. 15. He believes this to be the largest plant for the study of discharges of electricity that exists at present; it consists of 10,000 storage bateries, of which an illustration is given; it is combined with a Planté rheostatic machine, by means of which he obtains over 1,000,000 volts, producing a spark in air more than 4 feet in length. Each cell is composed of a test tube 5.5 inches long and 0.75 inch internal diameter, containing two strips of lead separated from each other by rubber bands, and immersed in sulphuric acid; each has an internal resistance of 0.25 ohm; they are mounted in sets of three in blocks of wood which have been carefully paraffined; the battery gives 8 amperes (!) at 20,000 volts. He found that X-rays require at least 100,000 volts. With the rheostatic machine, condensers are charged in parallel and discharged in series; there are sixty condensers made of plates of glass 15" x 18", coated on both sides with tinfoil, and with 20,000 volts he can therefore obtain 1,200,000; this machine, which is illustrated, is operated by lever arms instead of the usual cylindrical commutator. Besides the results already noticed in the previous article, he states that he has shown conclusively that the length of the spark between points separated by more than 1 inch varies directly with the E. M. F.; a spark 48 to 50 inches long requires 1,200,000 volts, and a lightning discharge one mile long would therefore require over 100,000,000 volts. Burns like those produced by X-rays will be obtained if the hand is exposed to the brush discharge from the terminals of this machine. He shows that there is no use insulating lightning rods; also that no vacuum tube which he could produce could resist the discharges due to this voltage.

INFLUENCE OF LIGHT ON THE SPARK DISCHARGE. Merritt. "Phys. Rev.," Nov.-Dec.—A short description of a lecture experiment to show the influence of ultra violet light on the spark discharge.

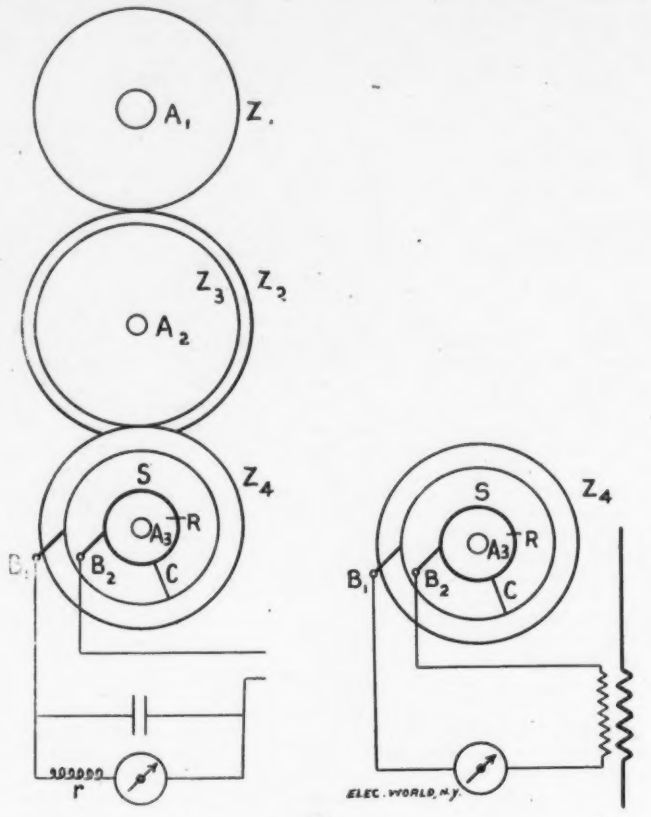
DISCHARGE OF ELECTRIFIED BODIES BY X-RAYS. Child. "Phys. Rev.," Nov.-Dec.—The conclusion of his long article, the first part of which was noticed in the *Digest*, Nov. 20.

ELECTROSTATIC CAPACITY OF A TWO-WIRE CABLE. Patterson. "Phys. Rev.," Nov.-Dec.—A reprint of a short A. A. A. S. paper read last August. As no treatise gives an expression for the electrostatic capacity of a two-wire cable, a matter which is of great importance in telephony, he deduces the expression for two concentric conductors and then for two equal and parallel conductors.

CHANGES IN LENGTH PRODUCED BY MAGNETIZATION. Brackett. "Phys. Rev.," Nov.-Dec.—A long article with numerous curves and tables, on the effects of tension and quality of the metal upon the changes in length produced in iron wires by magnetization. After some historical notes on the subject, he describes researches made by him at the suggestion of Professor Rowland. The apparatus and methods are described and the results given. In his conclusions he believes the investigation has established the following laws under the conditions like those used in his researches; "any increase in the magnetic induction tends to lengthen the iron wire;" "the magnetizing field tends to shorten the wire, and the shortening due to this cause apparently has no limit. Up to a field of 200 or 300 the shortening seems to be directly proportional to the field strength, and then it seems to begin to approach asymptotically some limiting value;" "the elasticity changes with the induction, the modulus being in some cases one-half per cent. greater at the highest magnetization than when the magnetization began. But the law of the change is unknown further than that electricity changes only as the induction changes."

UNITS, MEASUREMENTS AND INSTRUMENTS.

CONTACT DEVICE FOR TAKING ALTERNATING CURRENT CURVES. Sahulka. "Zeit. fuer Elek.," Jan. 2.—An illustrated description of an improved device, the object of which is to enable the curve to be taken rapidly. The upper gear wheel in the adjoining figure is on the dynamo shaft, and has n teeth gearing into the second, which has $n + l$, and is rigidly connected with another having n teeth, which in turn gears with the lowest, which has $n - l$ teeth; this last wheel has the usual contact devices, R being a metal ring and S an insulated disc with the contact C. While the dynamo makes $n + l$ revolutions the disc will make one turn more, and thus it is possible to obtain successive readings in the galvanometer without adjusting the brushes; the succession is sufficiently slow that the galvanometer can be read each time; if a reading is taken every five seconds there will be 32 values in a quarter of a period, in a certain case which he cites as an example. In the usual form of contact it must be made very narrow to give accurate results, as the galvanometer must be very sensitive, the resistances high, and condensers are required, but if the arrangement in the second figure is used neither a sensitive galvanometer nor condensers nor high resistances are needed; the contact in this case is of such a width that contact is made during a half period; in the circuit of the current whose curve it to be taken, is a coil of a few windings, and this acts on the secondary coil of a greater number of windings and in series with the contact and galvanometer; the deflection of the galvanometer will then be exactly the momentary value of the current at the time of the closing of the contact, or to the equal value after a half period when the current is broken, and it is independent of the values between these two; the deflection of the



galvanometer is proportional to the number of revolutions of the dynamo and by changing the distance between the primary and secondary coils the sensitiveness may be varied; no standard resistances are necessary, and it can easily be shown that even a Weston millivoltmeter can be used, as he shows by an example; when a sensitive galvanometer is used the number of windings and size of wire may be much smaller. If a voltage curve is to be taken the primary coil should be connected between the two points in series with the resistance; if the curve of a field is to be taken, the secondary coil is brought into that field; to determine the curve of the field in an iron core a few windings are placed around the core, and are used as a secondary coil; two curves can be taken simultaneously with two contact devices; another advantage is that there are no sparks at the contact.

DIRECT READING PHASE METER. Tuma. "Zeit. fuer Elek.," Jan. 2.—An abstract of a recent paper read before the Electrical Society of Vienna. He describes an instrument devised by him which is independent of the current strength, the deflection depending only on the phase difference. There are two circular coils at right angles to each other, through which the two currents flow; in the middle is a small needle of soft iron, in vaseline, and this will take a definite direction; if the angle which the needle makes with the perpendicular to one of the coils is a, and the phase difference angle b, he found the simple relation that $\tan 2a = \cos b$; this is based on the assumption that the two currents have the same intensity; this he determines by leading the two currents through coils without iron, which induce currents in two secondary coils, which pass through a Wheatstone bridge with two platinum wires. He then showed a second arrangement, which appears to be more practical; it consists of two "crossed coils," one of which is stationary, and the other can revolve in the inside of the first; each of the currents is divided, one part being led through an inductionless resistance and the other through a high self induction; one of these branches is connected with one of the crossed coils, and the second with the other, so that two rotary fields are produced having the same direction; it appears that a spherical winding is necessary to make a homogeneous field; the two rotary fields will follow each other by an amount represented by the phase angle and indicated by the deflection of the movable coil. This may be simplified by replacing the movable crossed coil by a simple, light coil, through which the second alternating current flows; an instrument constructed in this way, which is said to be very exact, was shown and the independence of the reading and the current strength were shown; a condition seems to be that the amplitudes of the partial fields of the two crossed coils are equal.

BEST RESISTANCE FOR A SENSITIVE GALVANOMETER. Laws. "Phys. Rev.," Nov.-Dec.—A short article in which he solves the problem for conditions other than those usually imposed; he first gives the usual solution of the problem, which is that the deflection will be a maximum when the galvanometer resistance is equal to that of the remainder of the circuit; in this, two assumptions are made, namely that the coils have fixed dimensions, and that the ratio of the diameter of the covered to that of the bare wire is the same for all sizes; the second assumption is not correct. He then discards the first assumption of fixed dimensions, and discusses the constants of a family of similar instruments, showing that the sensitiveness of those wound for various resistances with the same size wire is proportional to the cube root of the galvanometer resistance; also that for a family of instruments of the same resistance the best wire will be that for which the quotient of the sixth root of the resistance of a unit of volume of the wire, divided by the ratio of the diameter of the covered to the bare wire, is a maximum; experimental coils were wound for determining this function, the table of values being given. He then gives the formula for the best galvanometer resistance, and concludes that the best of the family is one wound with a No. 34 wire to a resistance equal to one-half of the remainder of the circuit. He then discusses two special examples, showing that the deflection when thus designed will be 60 per cent. greater than according to the usual law; the results show the advantages of small instruments; he also shows that there is a limit below which it is unprofitable to reduce the size of the instrument, this being the size for which a No. 34 wire is appropriate. In the second example he takes the case of a Wheatstone bridge with nearly equal arms of 1 ohm each, showing that the sensitiveness may be increased to about 200 per cent. by applying his laws. The gain is much greater with low than with high resistance instruments; it would be impossible, however, to reduce the size of the instruments as much as is indicated; he does not consider the magnetic system or the space for the free movement of the needle. He concludes that with the existing apparatus the sensitiveness may be increased by winding the galvanometer with wire of a particular size and a resistance equal to half of that of the remainder of the circuit.

NEW FLICKER PHOTOMETRY. Tufts. "Prog. Age," Jan. 15.—The beginning of a reprint of a graduation thesis from the "Transactions N. Y. Academy of Sciences," 16, p. 190. After a discussion of the usual photometric method, in which the differences in the luminosities of two adjacent surfaces are compared, he discusses the other methods, with special reference to the one suggested by Rood, and described in the "American Journal of Science," September, 1893; this method is independent of color, and depends on the shock which the retina experiences when one surface is withdrawn from view and replaced by another of different luminosity, the method being called the "flicker method;" he begins a detailed description of the apparatus used in his investigations with this method.

DETERMINING THE MOST PROBABLE VALUE OF A FUNCTION. Dommerque. "Elec. Eng'ing," Jan. 15.—A short article of a mathematical nature, calling attention to the distinction which should be made between the average and the most probable value of a function from various observations, showing how the most probable value should be calculated for both straight lines and curves.

INSULATION OF TESTING INSTRUMENTS. Wright. "El'ty.," Jan. 19.—A reprint of the article noticed in the *Digest*, last week.

TELEGRAPHY, TELEPHONY AND SIGNALS.

TELEGRAPHY IN FRANCE.—Lond. "Elec. Eng.," Jan. 7.—A note stating that the expenses for the year 1896-7 amounted to about $8,500,000, and the income to $7,500,000, leaving a deficit of about $1,000,000; it appears furthermore that the more telegrams there are sent the greater the loss.

TELEGRAPH. Lodge. Lond. "Elec. Eng.," Jan. 7.—An abstract of his fifth lecture at the Royal Institution.

TELEPHONE STATISTICS.—Lond. "Elec.," Jan. 7.—An editorial note correcting the figures recently published in "Electrical Engineering" (Chicago) for England. The total number of instruments of the National Company is 122,370, and adding those of the post office and the private telephones, the number would be about 200,000, instead of 75,000.

TELEPHONY IN NEW YORK.—"Elek. Zeit.," Jan. 6.—A long abstract, with large tables, of the statistics of the telephone company in New York City.

ELECTRIC CLOCK.—"Elek. Zeit.," Jan. 6.—A brief illustrated description of the Spohr system, in which clocks are driven by impulses from a master clock every minute. The mechanism of the receiving clock consists simply of a permanent magnet having a pivoted armature at each end, both of which drive the wheel to which the hands are secured; there are also two parallel electro-magnets, so connected in series that a current in one direction will attract both armatures to one electro-magnet, and a current in the other direction will pull both to the other magnet; the permanent magnetism is sufficient to lock the mechanism between the intervals of the current.

CONSTRUCTION OF THE TRANSMITTER INDUCTION COIL. Wietlisbach. "Elec. Eng'ing," Jan. 15.—A brief illustrated article showing how such coils should be constructed, and how the induction in them may be measured.

THE BERLINER PATENT.—"Elec. Eng'ing," Jan. 15.—A reprint of a letter by Critchfield, which is intended to show how weak the legal position is of the independent telephone companies in the unlawful use of the microphone patent.

MISCELLANEOUS.

IGNITION OF FIRE DAMP AND COAL DUST BY ELECTRICITY. Heise and Theim. "Elek. Zeit.," Jan. 6.—The first part of a long report of some elaborate tests made to find the action of electric sparks, such as would take place with electric machinery, on the inflammable gases in coal mines; the tests were made during the fall of the past year. After giving a brief summary of previous researches made in Germany, Belgium and France, they describe the present tests, which were made under present conditions; they did not include the effect of the rupture of a cable, as that is thought to be a very exceptionable and special case, which would not be likely to take place in a well constructed installation. The experiments were made in a specially constructed short length of tunnel, made of wood bound with iron hoops and placed under the earth; safety holes covered with stretched paper and strong glass windows were provided; the gases were mixed in various proportions between 6 and 14 per cent., which are the limits between which the mixture is explosive; the coal dust was made artificially, and consisted largely of coke, it being very easily ignited. The present portion concludes with a description of the apparatus.

FATALITIES FROM LOW-VOLTAGE ALTERNATING CURRENTS.—"Elek. Zeit.," Dec. 30.—An editorial describing briefly four cases occurring within a short period at the same chemical factory, in which the voltage was not higher than 110 volts, or in one case, perhaps, 230. The first was that of a man trimming an arc lamp while barefooted, the lamp having being lowered and an accidental connection with the suspended wire and reel having been made by the swinging of the lamp. In the second case a workman took hold of a wire outside of a window. In the third case connection was made with an iron conduit, through which the insulated wires had been drawn, the conduit not being grounded. In the fourth case the victim was found on the ground with a hand lamp in his hand. Attention is then called to the fact that there is a decided difference in the physiological action on the different workmen, as the same circuits had been repeatedly touched by others without danger. In the first three cases the contact was made by a tight grip; the condition of the skin seems also to have some effect. The conclusions arrived at are that low voltage insulation should be subject to the same rules as those for high voltages. A long abstract is published in the Lond. "Elec. Eng.," Jan. 7.

ELECTRICITY AND DERMATOLOGY. Hedley. Lond. "Elec. Rev.," Dec. 31.—A short article calling attention to the fact that the static breeze from an influence machine has quite a strong effect on the skin, and is more effective than any of the numerous hair restoratives. Bordier showed that the action on the screen from the negative terminal is more powerful in the vasometer and sensory effects than that from the positive pole. He then refers to the recent suggestion made by Tesla to use a high charge on the skin for throwing off extraneous particles, such as constitute certain pathogenic micro-organisms; he seems to think the suggestion is a plausible one. The article is reprinted in the "Elec. Rev.," N. Y., Jan. 19.

GUTTA PERCHA. Obach. Lond. "Elec. Eng.," Jan. 7.—The beginning of a reprint of his recent lectures, which have been briefly noticed in the *Digest*, Dec. 25 and Jan. 15.

BIOGRAPHICAL.—Lond. "Elec. Eng.," Jan. 7.—A brief biography, with portrait of Francis Hughes Webb, who has been the secretary of the Institution of Electrical Engineers for the past twenty years.

SUMMARY OF ELECTRICAL EVENTS IN 1897.—Lond. "Elec.," Jan. 7.—Several columns of events in chronological order; it is chiefly of local interest. A long editorial on the same subject is also given.

REVIEW OF THE PAST YEAR.—"Zeit. fuer Elek.," Jan. 2.—A short editorial review.

EXPIRING BRITISH PATENTS.—Lond. "Elec. Rev.," Jan. 7.—A list of the electrical patents which expire during the present year.

EXPORTS.—"West. Elec," Jan. 15.—A reprint of a list from the statistics of the Treasury Department, showing the value of the exports of electrical apparatus from each of the cities and to each of the countries; a brief abstract appeared in THE ELECTRICAL WORLD, Jan. 15.

BIOGRAPHICAL.—"Can. Elec. News," Jan.—A short biography, with portrait, of H. P. Dwight, the president and general manager of the Great Northern Telegraph Company in Canada.

ELECTRICAL ADVANCE IN THE PAST TEN YEARS. E. Thomson. "Elec. Rev.," Jan. 19.—A reprint of the article noticed in the *Digest*, Jan. 15.

Book Reviews.

THE INTERNATIONAL ELECTRIC LIBRARY is the title of a series of six quarto volumes just brought out by the American Technical Book Company, 45 Vesey Street, New York City. The joint authors of this work are Prof. E. J. Houston,, Dr. A. E. Kennelly and Prof. Silvanus P. Thompson. Volumes I. and II. consist of an encyclopædic electrical dictionary prepared by Professor Houston; Volume III. is entitled "Recent Types of Dynamo Electric Machinery," the authors being Messrs. Houston and Kennelly; Volume IV., by Silvanus P. Thompson, is devoted to the subject of polyphase electric currents and alternating-current motors; and Volumes V. and VI. treat of dynamo electric machinery, the author being Professor Thompson. Nearly 2000 fine wood cuts, diagrams and half-tone engravings appear in the set, and appear to the best advantage by being printed in extra half-tone dark green ink, the text being in black. The volumes are bound in half morocco leather, with cloth sides and gold lettering. The six volumes contain nearly 3000 pages, with twenty-five folding plates additional. They are sold exclusively by subscription.

THEORY AND CALCULATION OF ALTERNATING-CURRENT PHENOMENA. By Charles Proteus Steinmetz, with the assistance of Ernst J. Berg. Second edition, revised and enlarged. Published by the W. J. Johnston Company, New York. Price, $2.50.

This book does not differ greatly from the first edition of the same work, the chief changes being the correction of a number of errore and the addition of some new material, particularly in the discussion of the concatention or tandem control of the single-phase induction motor, the synchronous induction motor and the hysteresis motor. The work takes up alternating-current phenomena involved than the graphical method. What is known also as the topocomplete work on this subject, the use of the higher mathematics. The laws are developed and represented by graphical representation, and also by what is known as the symbolic method in which the vector, describing the sine wave in the polar diagram, is represented by its rectangular co-ordinates, this method allowing a more ready calculation of the numerical values of the phenomena involved than the graphical method. What is known also as the topographical method is used, this differing from the graphical in that the potential of different points on the circuit is represented by points in a diagram, their distance from the zero point giving the intensity, their amplitude the phase of the difference of potential, and their relation to the other points giving the intensity and phase difference from the other parts of the circuit represented. The calculus is omitted almost entirely from the work, in order to adapt it to the study of those not familiar with this branch of mathematics.

SHOP AND ROAD TESTING OF DYNAMOS AND MOTORS. A Practical Manual. By Eugene C. Parham and John C. Shedd. Published by the W. J. Johnston Company, New York. Price, $2.00.

This work combines in a very happy manner a scientifically correct treatment of the theorist with the handy, simple ways of getting at things of the practical man. This may be due to the professions of the two authors, the first being the electrician of the Steel Motor Company, and the second professor of physics at Marietta College. The work gives a complete theory of the methods of commercial testing as far as they relate to direct-current machines, and then gives the many applications of the theory to practice. It is also intended to serve as a handbook for operating engineers for direction in their own repair work and testing One department is devoted purely to instrument testing, treating the instruments and the formulæ in such a way as to give, so far as possible, physical conceptions of the quantities discussed. The work, although very complete, filling a volume of over 500 pages, is so carefully arranged and thoroughly indexed that any point may be looked up without trouble.

The New Lynn Incandescent Lamp.

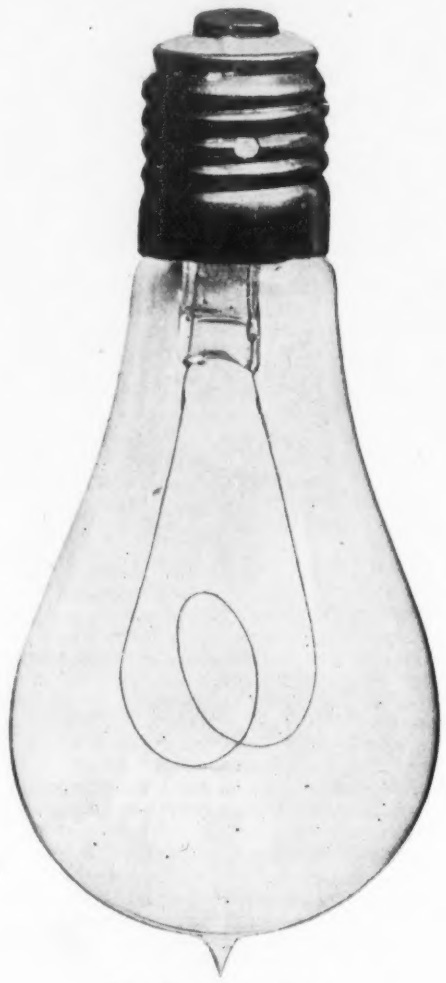
In the course of the large and peculiar experience acquired by the Lynn Incandescent Lamp Company, Lynn, Mass., in the business of renewing burned out lamps, it was but a natural consequence that it should note the defects of lamps of different makes. With such knowledge of the weak points in lamps of existing types, the company's attention was naturally turned to the advisability of itself producing a lamp that would embody the good points of the best types on the market and be free from their defects. Equipped with this valuable experience the company has entered the field with a new lamp which is claimed to be unequalled in its most important features, and which possesses the life and sustained candle-power of the company's renewed lamps.

In becoming the pioneer of a new industry—that of renewing burned out lamps—the company laid the foundation for a business of equal importance, that of manufacturing new lamps. This was a logical consequence of the original undertaking, and it may be truthfully said that the company "builded better than it knew."

The new incandescent lamp, according to information recently promulgated by the Lynn Incandescent Lamp Company, possesses the important qualities of uniformity, long life and maintenance of candle-power. It is made in all the standard sizes and for standard voltages and bases.

In the construction of its new lamp, the company does not use cellulose filaments. It believes that the "flashed surface" on the filament is the necessary factor and therefore uses a material of higher specific resistance than cellulose, and one which admits of the greatest possible amount of "flashed surface." It has been the effort of the company to meet the demand from critical consumers for a uniform, efficient and high-grade lamp, equal to its renewed lamp in life and sustained candle-power. One of the principal factors of the success of the Lynn Company in the manufacture of its lamps is its method of producing high vacua. On January 4, this year, letters patent were issued to Mr. E. F. Dwyer, president and manager of the company, on a process of producing high vacua, which consists, substantially, of removing the main portion of the gases contained in the lamp bulb by pumping. A current is then passed through the filament and the exhaustion continued. A 16-cp lamp is run at about 32 candle-power, which brings the filament to an extreme white heat and excludes all the occluded gases contained in the filament. This is a new feature of lamp factory practice, the old idea being that the lamp would be strained if run above the normal candle-power; this would be true if the lamp were finished. The blackening of the bulb of the lamp is due to the condensation of the volatile carbon given off by the filament, and, also, from small particles of carbon thrown off mechanically, and by burning the filament to this extremely high temperature, all of these gases are thrown off and carried away by the pumps, the whole carbon becoming one homogeneous mass.

But, going back to the method of exhausting lamps. The gases remaining in the lamp bulbs are mainly those which were purposely added druing the process of exhaustion. As the lamp cools, this remaining vapor condenses upon the cooler portions as a solid, leaving an almost absolute vacuum in the bulb.



The New Lynn Lamp.

The vacuum is too high to admit of the discharge noted in Crookes tubes, in the vacuum tubes used in the X-ray work and in incandescent lamps exhausted by the mercury process. The advantage of the high vacuum, aside from the absence of actual burning of the carbon by the remaining air, is that it prevents the escape of heat through the bulb. A lamp with a poor vacuum is hot to the hand, due to the escaping heat, and one with a high vacuum is cool, indicating that more of the power put into the lamp has been converted into light. Mr. Dwyer states that by this process the work of exhausting bulbs is greatly facilitated, and that a greater number of lamps can be produced in this way, in a given time and space, than by any of the processes hitherto used or known. An important factor of the process is a mechanical pump which rapidly produces the necessary rough exhaustion. This pump in itself will, it is said, exhaust lamps equal to a mercury pump, and can be used without the chemical process, but the latter saves much time, and, as stated above, gives the almost perfect result.

A New Third Rail System.

There is on exhibition in the Lord's Court Building, in New York City, a model of the third rail electric railway system invented by Mr. William A. P. Willard, Jr., of Boston, Mass., in the development of which Mr. Willard sought to meet the demand for a system that was at once practical, safe and cheap. The inventor states that his system is not designed for street service, but is intended more particularly for elevated railways and suburban roads now operated by steam.

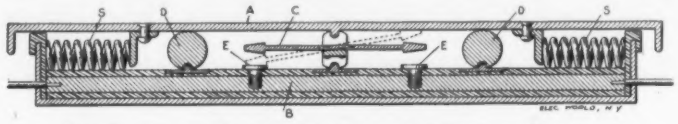
The third rail, which is laid on the ties parallel with and between the service rails, is divided into sections, every section being normally "dead," except the one immediately beneath the motor car. The surface rail is movable to a limited degree in a longitudinal direction, either way. Motion is imparted to it by the friction of the shoe on the moving car, and the rail is then brought into contact with the electric conductor by means of the mechanism shown in the illustration and described.

By reference to the accompanying illustration, which is a longitudinal view of a rail section, the operation of the system may be readily comprehended.

The rail practically consists of a box-like structure provided with a cover, *A*, which latter constitutes the surface rail. The iron box is lined throughout with insulating material. The switch or contact-making device consists of a rocking lever, *C*, which is operated by the longitudinal movement of the rail. The lever is supported at its centre on a rocking device, which is grooved on the top and bottom, the grooves engaging in saddle pieces, the lower one being fixed and the upper one, being an integral part of the surface rail, moves with the latter. Motion of the rail tilts the rocking lever one way or the other, according to the direction in which the car is moving, and establishes electrical contact between the conductor *B* and the surface rail, as indicated by the dotted lines. The connection shown, it is evident, is the result of the motion of the surface rail toward the left. The surface rail rests upon two roller bearings, *D*, which are grooved underneath, and set upon stationary saddle pieces. It requires a movement of only three-eights of an inch either way to effect electrical contact between the conductor and surface rail.

The electric conductor *B* is preferably square or rectangular in section, in order to fit the space at the bottom of the box. On top of the conductor is a layer of insulation. By this construction, it is evident that the conductor is completely insulated, and the only exposed points are the studs, *E*, which represent the contact points for the rocking lever. These studs are screwed through the insulation into the conductor itself. The conductor in each section is connected by bonds with those in adjacent sections, thus providing a continuous path for the current, the traction rails being used as a return.

Now, it is obvious that, with the surface rail laid in place on the top of the box, the advancing car will move it sufficiently to effect a contact between one



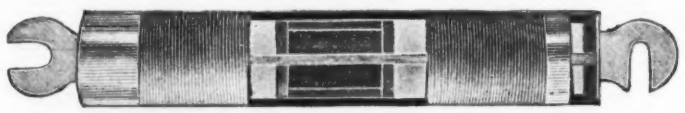
LONGITUDINAL SECTION VIEW OF A SECTION OF RAIL.

of the studs, *E*, and the surface rail through the medium of the rocking lever, thus rendering the surface rail "alive." When the rail is relieved of the friction of the shoe it is returned to its normal position by the action of the spring and becomes "dead."

It may be stated here that this particular method of connection between the surface rail and the conductor is referred to merely to illustrate the principle of operation. In practice, a switch, a sliding contact or any other approved means of opening or closing a circuit may be adopted in its place. The rail box is provided with a shoulder on each side, thus affording a means of clamping the surface rail down, so that it cannot be lifted off, but is free to move endwise. The design of rail illustrated herewith is subject to several modifications, and it is Mr. Willard's intention to introduce some changes for the sake of simplifying the device.

Air-Tight Fuses.

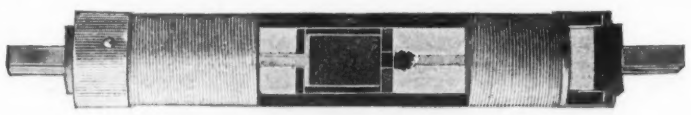
In the Cartwright enclosed air-tight fuses, the fuse is so constructed that the wire melts within the central chamber of the tube and the heated air and gases formed thereby force themselves to the end sections, thus blowing out the arc. This fuse can be used on any pressure less than 2200 volts. It is



FUSE COMPLETE.

stated that it will not maintain an arc between its terminals when short-circuited on the mains of a 2200-volt composite alternating dynamo.

The cut-out consists of two parts, namely, the base and tube. The tube is made of the best quality of Monson slate, and the tube is made of black or gray fibre. Owing to the peculiar construction of this device the fuse in a 3-inch tube will, it is stated, open the circuit, where other cut-outs require twice that length of fuse to operate under the same condition. This fuse has a definite length, cannot come in contact with any foreign substances, and will



FUSE BLOWN.

open the circuit in a pre-determined time on a given current. After a fuse has blown it is replaced by a new tube. Each fuse is marked with the maximum number of amperes it will carry indefinitely.

These fuses are manufactured by the Shawmut Fuse Wire Company, of Boston, Mass., under license from the Goodhart Electric Company.

An Ingenious Low-Water Alarm.

A novel form of low-water alarm for boilers has been described in the *Indian and Eastern Engineering*. A stand pipe, closed at the top and open at the bottom, is mounted in the boiler, with its lower end at the danger limit of low water level, its upper end projecting out from the boiler and exposed to the atmosphere, and carrying an ironclad thermometer with contacts of an alarm circuit fused into the stem. When the water level is at a safe height the cool upper part of the tube will condense the steam therein and keep the tube full of water, which, having no opportunity for circulation, will be comparatively cold. If, however, the water level falls below the open lower end of the tube the water will run out and the tube fill with hot steam, which will immediately send in an alarm by means of the thermometer. When the water level rises again the steam will condense, the water will fill the tube and cool off in the part of the tube exposed to the open, shutting off the alarm circuit. The design is so simple and so absolutely operative, owing to the absence of moving parts or mechanism which can get out of order, that it is worthy of commendation.

A New Quick-Break Switch.

The demand for a reliable quick-break switch led Mr. R. C. Demary, of Buffalo, N. Y., to devote some attention in this direction, with the object of producing an instrument that would, as far as possible, meet all the requirements demanded of such a switch. The aim of Mr. Demary has been to perfect a switch, at once compact and durable, and which, while highly finished, would

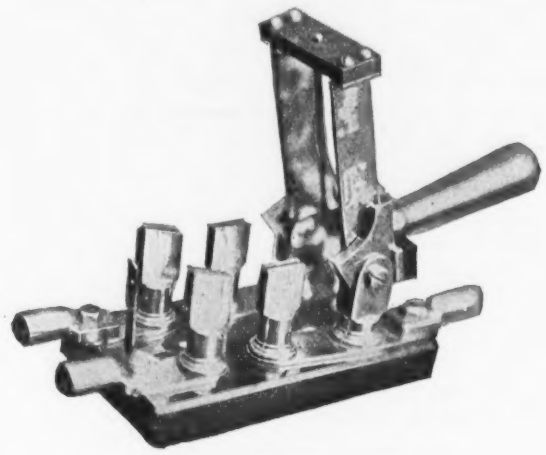


FIG. 1.—SWITCH OPEN.

stand the strain to which switches are subjected. The switch possesses the advantage of having an instantaneous break. It also has a locking device, consisting of a lever and catch, as shown in the illustration, which, it is claimed, insures a quick break, and does away with all sparking and other dangers. This locking device makes it impossible to open the switch until the full tension of the spring is attained, thereby making a quick positive break. The switch is manufactured in one grade only, and of the very best material; all parts carrying current are made from Lake Superior copper, and the instrument is finished throughout in the most workmanlike manner. The parts are standard in size, so that any breakage can be easily repaired. The carrying capacity of

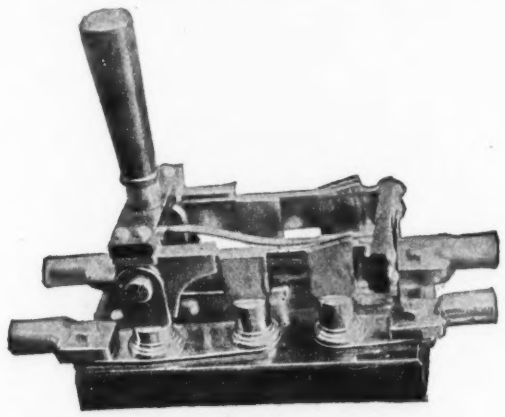


FIG. 2.—SWITCH CLOSED.

these switches ranges from 25 to 1800 amperes. The movable parts are arranged in such a manner as to be protected from dust and dirt.

It is stated that the Demary quick-break switch has been approved by the Fire Underwriters and many leading electricians. They are manufactured by the Akron Electrical Company, Akron, Ohio, but the entire output will be controlled by Mr. Demary, whose office is in the Erie County Bank Building, Buffalo, N. Y.

A Safety Third-Rail Traction System.

Owing to the unsightliness of overhead, the expense of underground and the danger of exposed conductors, there have been many attempts to get up a system in which the exposed conductor could be divided into short strips which could be energized only when current from them was desired, and when they were protected by the car standing over them.

Most such systems have been devised with magnetically operated switches which could be automatically closed and opened as the car passed over their respective sections, by currents passed in some way through solenoids controlling them. If such systems depend upon power-house current for the operation of the magnets their cars immediately become helpless if they drift over

one section, taking no current, and thereby failing to pick up the magnetic switch. They are then cut off from the power-house current on which they depend to energize the section of rail with which they are in connection and are stalled helpless. For this reason, such systems are, as a rule, equipped with storage batteries in the cars which may act upon the solenoids, and through them close the main circuit supplying power-house current to the third rail, and thence to the car motors. Here another difficulty comes up, in that the solenoids cannot be connected between the conducting third rail and the tram rails, as between these two points there is a potential difference of 500 volts as soon as the switch is closed, and coils capable of resisting this high pressure are not energized sufficiently by the low pressure of the storage batteries. This involves the necessity of a fourth rail, or, in systems using instead of a rail a series of conducting studs and a runner under the car, involves another set of these studs and a corresponding runner.

The Safety Third Rail Electric Company, Temple Court Building, New York City, has a system devised by Capt. J. McL. Murphy which overcomes this last difficulty. He boldly places on his car a source of electrical energy capable

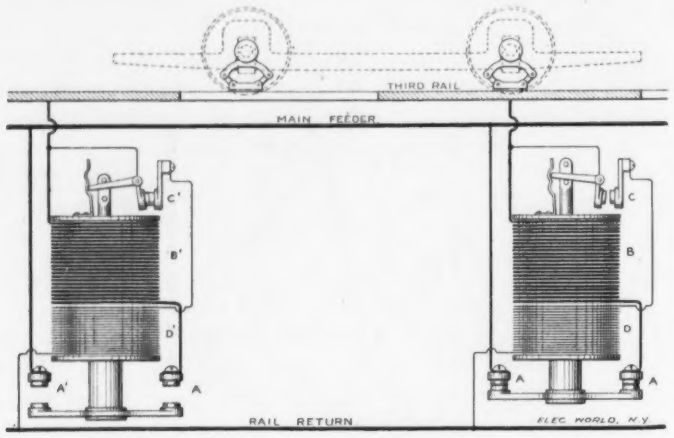


Diagram of Connections.

of giving 500 volts direct current, and by this means he is enabled to connect the windings of his switches direct between the third rail and the tram rails, and thereby avoid the necessity of a fourth rail, or its equivalent. The system is shown diagrammatically in the accompanying line drawing, in which there is indicated a car truck, showing directly under the main wheel axles, two contact shoes which bear upon the third rail. The latter is divided into sections with dead intermediate parts of any desired material between the live sections. For ordinary cars with an 8-foot wheel base and the standard overhang, the live sections are 8 feet in length, separated by dead sections 6 feet in length. In this way the forward shoe runs upon a new section before the trailing shoe has left the last one, and the sections which are rendered alive as soon as the shoe runs upon them are fully protected under the overhang of the car body and the platform.

As shown in the diagram, the shoe to the right is in contact with a section of the third rail, which is drawing current supplied from the main feeder through contacts, *A A*, and the coil *B'*. This latter holds up the plunger within the coil, and thereby maintains the circuit closed at the contacts *A A*. As soon as the car moves to the left sufficient for the forward shoe to come on the next section of the third rail, the current will pass from the rear shoe, which is alive, to the forward shoe connected with it, thence through the contact, *C'*, to the fine wire winding, *D'*, which will lift the plunger and close the contacts, *A' A'*, simultaneously opening the contact *C'*. This will supply the car through the series coil, *B'*, and forward shoe, so that when the following shoe leaves the section of the third rail on which it is shown, the current through coil *B* will cease, the plunger will fall, and the contacts *A A* will be opened, contact *C* being closed immediately thereafter, ready for the next car that may come along.

Obviously, if the car drifts over or in a section, it will take no current through the series coils, assuming that the lights and heaters are not in use. The magnets will, therefore, not be energized and the car must in some way supply current from itself for reconnecting itself to the power circuit. It will be noticed that in all cases the connections, *C*, of the fine wire winding are closed if the main connections are opened, and all that is necessary is to apply 500 volts between the tram and the third rails when the controller is put on the first point, to energize the fine wire windings, which will close the main circuit, and the current taken by the motors will pass through the coarse wire winding and maintain the plunger in its upper position. The auxiliary source of current is a storage battery of a few cells, connected to a small motor generator with a 10-volt winding on one commutator and a 500-volt winding on the other. The current necessary for the switches is but a fraction of an ampere, but the motor generator is preferably built of sufficient size to supply the lamps of the car in the evening. Obviously it is only used for a brief interval of standing, and the first instant of starting, until the power-house current comes across the terminals of the 500-volt commutator of the motor generator and tends at once to re-charge the battery.

The switches are made with carbon contacts which cannot bind or stick, and with gravity for a restoring force. The switches being only connected by wires with the rest of the system, can be grouped in manholes at convenient intervals, where they can be readily inspected and kept in order.

Lamp Inspector's Indicating Wattmeter.

A portable instrument to determine accurately and rapidly the watts per candle-power required by a lamp, is of great value in selecting new lamps and in testing lamps in service. The General Electric Company has recently designed and introduced the Thomson inclined coil portable indicating wattmetr to meet an increasing demand for instruments of this class. On account of the rapidity with which readings may be made, the indicating wattmeter will also be found invaluable for testing lamps in barrel lots, either with or without a photometer. The wattmeter will accurately indicate the energy used by small fan motors, and is, therefore, particularly useful in comparing, for a customer's benefit, the relative amount of energy required by a fan motor and an ordinary incandescent lamp. By supplying the secondary of a transformer with current, its core loss may be easily determined by the indicating wattmeter.

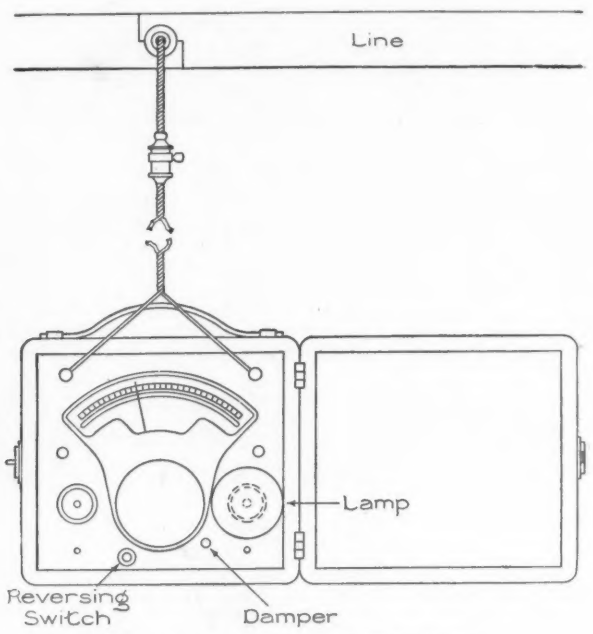
For rapid connection the wattmeter is supplied with two special plugs, thus providing ready means for connection to the three forms of sockets most generally in use. The lamp to be tested is inserted in one of the receptacles in the base of the instrument, and the proper plug placed in any convenient socket. Lead wires are provided, suitably tipped at one end for insertion in the plugs, and at the other for connection to the binding posts of the instrument.

The capacity of the indicating wattmeter is 150 watts. Lamps of any candle-power up to 32, and of any voltage up to 150, may be tested, as may also any device, the consumption of energy in which is not over 150 watts at any voltage not exceeding 150.

The fact that the instrument is equally well adapted for use on either direct or alternating currents, necessitates the use of only one instrument in stations using both systems. A special reversing button is provided to reverse the current in the instrument and lamp when used on direct-current circuits without permitting the needle to fall back to zero.

Another advantageous feature of the instrument is the damping device. A button is provided, which releases the needle or pointer from the damping brake only when depressed. When the button is released the needle is held at the point of the last indication; therefore, if the current is turned off and then on again, or reversed, the necessity of waiting for the pointer to swing from zero to a state of rest is avoided, and very rapid readings may be taken. The terminals, reversing and damping buttons are mounted on a vulcanite baseboard, above which the graduated dial slightly projects. The instrument is mounted in a finely polished carrying case. It is light and compact, the external dimensions being 7⅜ x 7 x 4½ inches. All parts are finished in polished nickel plate.

Indicating Wattmeter.



Method of Connecting Wattmeter.

Mechanical Versus Natural Draft.

The chimney is such an old and commonplace device that few people take time to consider what its real functions are and how well or ill it performs them. One duty of a chimney is to remove the waste gases of the fires, but a far more important function is the creation of a partial vacuum, which shall draw the air necessary for combustion through the resisting bed of incandescent material. In this respect a chimney is a heating engine, the power being abstracted from the heated gases rising in it and transformed into energy expended after the manner of an air pump, removing the gases from the partial vacuum above the fire to the full atmospheric pressure outside. The action is, of course, very simple, and due to the fact that the weight of the hot gases in the chimney is less than that of the cold air outside, therefore giving a tendency to rise. This action evidently depends upon the heat left in the gases after they have performed their useful work on the boiler heating surfaces, and is obviously more effective as this waste heat is greater, the chimney being absolutely useless in this respect if all the heat of the products of combustion is extracted for useful work in the boiler.

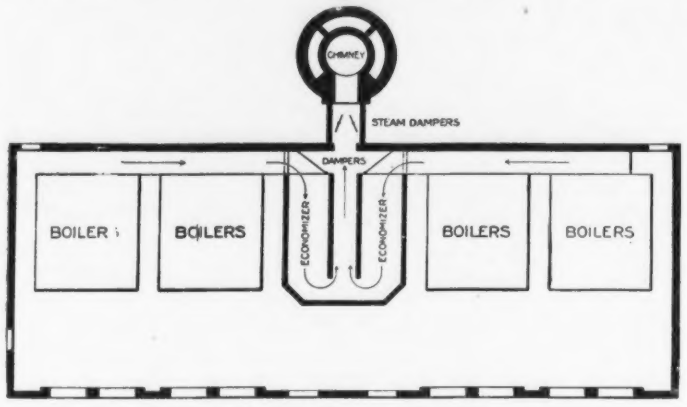


FIG. 1.—PLAN OF BOILER HOUSE WITH NATURAL DRAFT.

It is interesting to note how great this heat is and how small by comparison is the effective work it performs. With the ordinary hand-fed natural draft fire, a representative value of the temperature of the flue gases is about 500°, and the air supplied may be taken as about 24 pounds per pound of coal, or about 100 per cent. more than that necessary for ideal combustion, and with these values the ratio of work actually done to heat wasted by the chimney, assuming a draft of 3.47 pounds per square foot, would be 0.05 per cent., a very poor efficiency. Of the heat actually generated by the combustion of the fuel under these circumstances, about 20 per cent. is lost by the chimney. By means of economizers, feed-water heaters and other heat transferring devices, a considerable part of this waste can be saved, the immediate result being, however, a reduction of the draft to a point below that needed for good combustion. In fact, even with this 20 per cent. waste, in chimneys of extreme height the draft is not what it should be for best effects. The best fire is that in which the air supply is intimately intermingled with the hydrocarbons to be burned with a minimum excess of air above that needed for perfect combustion and consequently a maximum furnace temperature. With natural draft the fires are limited to a certain thickness, greater than which the draft is not sufficient for drawing the air. With these thin fires it is difficult to keep the thickness uniform, and in the thinner places a great excess of air will pass through, cooling the furnace and carrying away in the chimney a large amount of wasted heat. With mechanical draft almost any desired air pressure can be obtained, and the fires can be made thick, either with or without a reduction of the grate area, and greatly improved combustion is the result.

Besides its inefficiency and ineffectiveness, the chimney is, as a rule, a very expensive piece of apparatus. In Fig. 1 is shown a plan of a representative battery of eight boilers of 200 horse-power each, nominal rating, with a chimney 8 feet in internal diameter, and 180 feet high, sufficient to overcome the resistance of the economizers and produce the necessary draft. The cost of such a chimney is estimated in the work on "Mechanical Draft," issued by the B. F. Sturtevant Company, Boston, Mass., at $9000, and that of the whole plant at about $58,000. Fig. 2 shows an end elevation of the arrangement of short stack and blowers for the same plant, the cost of the mechanical draft apparatus being approximately $3500, a saving of $5800 over that of the stack and the necessary dampers. Besides this the space occupied by the chimney is saved, which, in expensive locations, will amount to many dollars more, and by means of the mechanical draft the boilers may be forced to a much higher rate of steam production in time of heavy load, and the boiler plant may therefore be reduced by at least one-eighth, a further saving of $4000 or $5000.

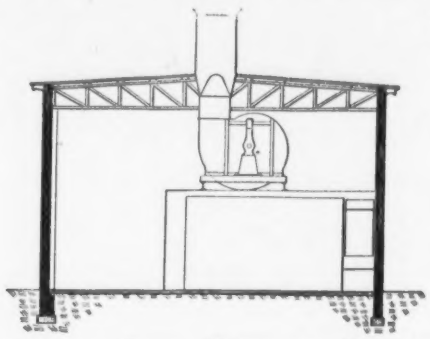


FIG. 2.—ELEVATION OF BOILER HOUSE WITH MECHANICAL DRAFT.

Another advantage of the mechanical draft is its ready control. The draft can be adjusted from nothing up to full power almost instantly by the turning of a throttle valve, if the blower is engine-driven; by a switch, if motor-driven, and, further, if automatic control is necessary, this can be effected by means of an automatic device, which increases the fan speed as the steam pressure falls, and vice versa. The fan is also independent of climatic conditions. Damp and muggy days have no effect in deadening the fires. The draft can also be made as strong in summer as in winter. The amount of steam that must be supplied for the operation of the fan depends, of course, upon the character and size of the plant. Tests on many fans show that the average indicated horse-power of the blower engines is only about one-half to 1½ per cent. of the total boiler output in plants of reasonable size. The exhaust steam can almost always be utilized for feed-water heating, thus reducing the steam expenditure to practically nothing. The mechanical blower also allows of the combustion of cheaper fuels, as natural draft does not. Blowers of all styles and kinds for this apparatus are made by the B. F. Sturtevant Company, both belt-driven and direct-coupled to engines or motors. In the case of motor-driven, of course, the high steam economy of the dynamo-driving engine is utilized with very little loss between the main engine shaft and the blower shaft.

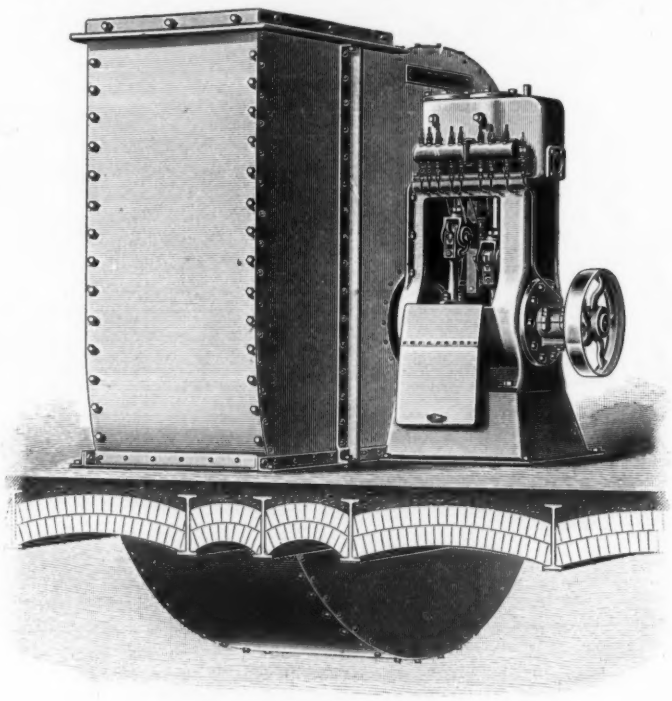


FIG. 3.—STEEL-PLATE, ENGINE-DRIVEN FAN.

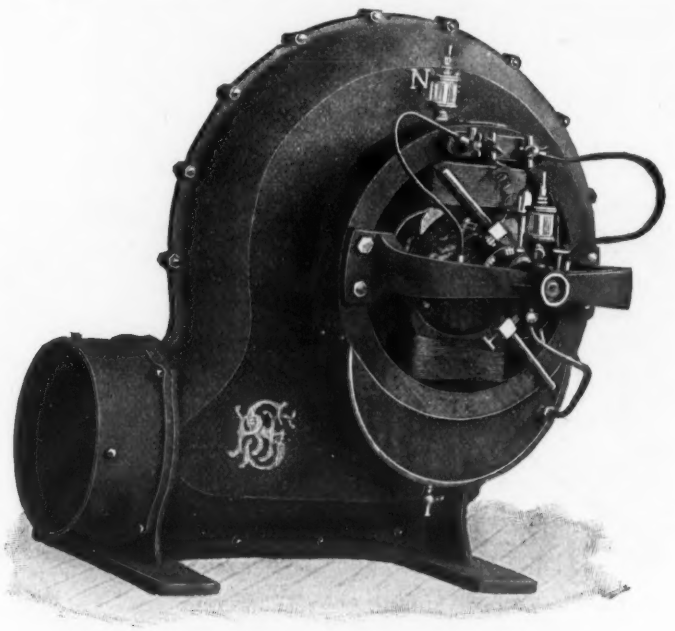


FIG. 4.—MOTOR-DRIVEN FAN, MONOGRAM PATTERN.

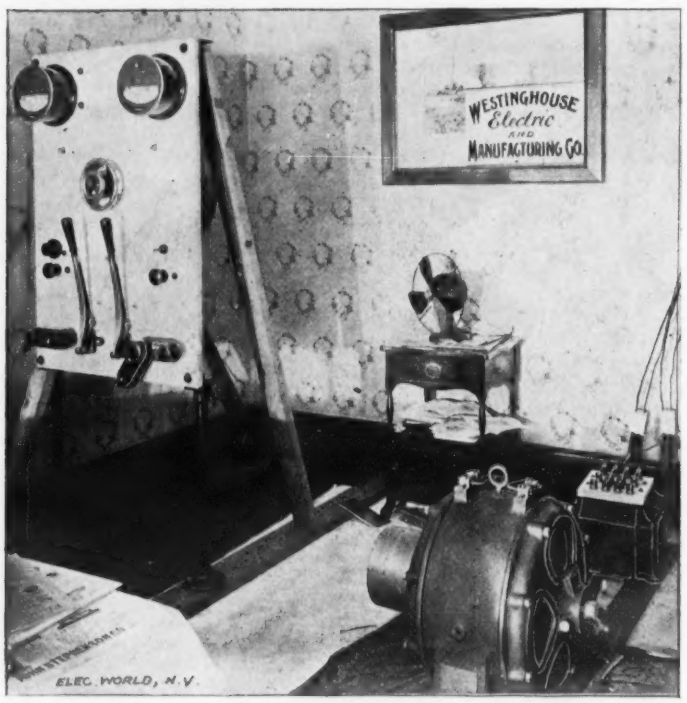
Notes of the Milwaukee Convention.

MESSRS. MEYSENBURG & BADT, Chicago, exhibited samples of the K. & W. Company's specialties, including hanger boards, spark arresters, commutator compound and a bank of Hardy incandescent lamps. The lamps included the 16-cp 220-volt type. Considerable literature of an electrical nature was distributed by Meysenburg & Badt, including catalogues of the Weston

Meysenburg & Badt's Exhibit.

Electrical Instrument Company, pamphlets singing the praises of "Electra" carbons, imported by Mr. Hugo Reisinger, and a full line of circulars of the Carpenter and Ward Leonard enamel rheostats, theatre dimmers, speed regulators, resistance plates, etc., manufactured by the Ward Leonard Electric Company, of Bronxville, N. Y. A sample of the elastic copper amalgam bonds and the Edison-Brown plastic bonds was also shown. The representatives of the firm were President F. B. Badt and R. F. Schuchardt, of Chicago, assisted by Mr. Gatty, of Milwaukee. The Helios enclosed arc lamps, both for direct and alternating current, which were shown in this exhibit, were looked after by Messrs. Rohn and Meyer, of Milwaukee, State agents.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, Pittsburg, Pa., had the only exhibit of polyphase apparatus at the convention. It showed in operation one of its latest types of 5-hp induction Tesla motors, without brushes. The company also exhibited one of its new tablet switchboards for alternating-current work. The board is very handsome and in every way up to the Underwriters' requirements. Other apparatus exhibited was an alternating-current brushless type fan motor, a C. S. converter,

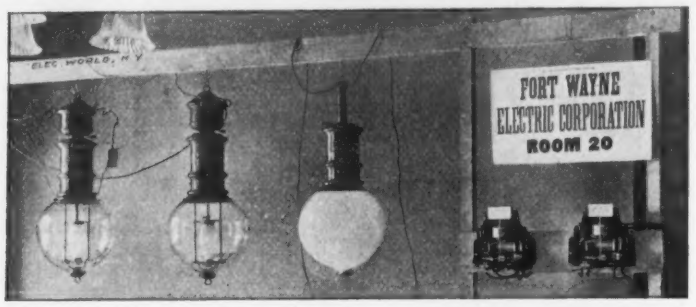


The Exhibit of the Westinghouse Electric & Mfg. Co.

having interchangeable 1000 or 2000 volts primary and 50 or 100 volts secondary, and a Shallenberger wattmeter. A full line of catalogues, illustrating and describing various lines of apparatus manufactured by the Westinghouse Company, was also plentifully distributed. The company was represented by Messrs. Henry Floy, W. S. Rugg and W. H. Whiteside.

THE McDERMID MANUFACTURING COMPANY, Chicago, was very ably represented by its secretary and treasurer, Mr. C. L. Burlingham. In connection with the manufacture of annunciators, switches, spark coils and battery coppers, this company is pushing a preparation for cleaning wood work of railroad cars, which does its work very well. From what is known of this cleaner, Mr. Burlingham's friends state that it will not be necessary for him to go to Klondike next spring.

THE FORT WAYNE ELECTRIC CORPORATION, of Fort Wayne, Ind., had a very interesting operating exhibit of enclosed arc lamps and meters. The lamps were of the 110 and 220-volt direct-current and alternating-current types. The 220-volt direct-current lamps are designed to burn singly. The alternating-current lamps are built for any frequency, and are operated either from a regular transformer with an economy coil in the lamp, or from the company's special arc transformers, with any resistance or economy coils in the circuit. The meters are said to be absolutely accurate on all loads. The company was represented by Mr. E. L. Draffin, of Chicago, and Messrs. Thomas



Ft. Wayne Electric Corporation's Display of Lamps and Meters.

Duncan and F. S. Hunting, of Fort Wayne. Mr. C. G. Guild, of Fort Wayne, was also with the Fort Wayne delegation.

THE NEW YORK INSULATED WIRE COMPANY was represented by its Western manager, Mr. James Wolff. On account of recent bereavement in his family, however, Mr. Wolff did not participate in the festivities of the occasion, much to the regret of all present.

THE AFFAIRS OF THE ELECTRIC STORAGE BATTERY COMPANY, of Philadelphia, were looked after by Mr. Frank H. Clark, the company's new manager, who has made many substantial friends during the short time he has been in the West. Mr. Clark has been successful in enlarging the demand for the storage batteries made by his company, and is certainly doing good work in the West and Northwest.

THE CHICAGO INSULATED WIRE COMPANY, Chicago, was very well represented in the person of Mr. William M. Smith, secretary and treasurer of the company. Mr. Smith managed to find enough to keep him busy all the time, from start to finish.

MR. C. E. GREGORY, of Chicago, was on hand, as usual, and his fish stories and toasts were received with as much delight as ever.

MR. W. P. CLAWSON, electrician of the Goodrich Transportation, was a visitor at the convention.

THE AMERICAN RHEOSTAT COMPANY, Milwaukee, Wis., showed a

Exhibit of American Rheostats.

line of rheostats and a speed controller which attracted a great deal of attention. This exhibit was in charge of Mr. J. G. Hickcox, of the company.

THE CENTRAL ELECTRIC COMPANY, of Chicago, was represented by Manager Charles E. Brown and W. B. Upham. Messrs. Brown and Upham met among the delegates many old customers, who were pleased to make their personal acquaintance.

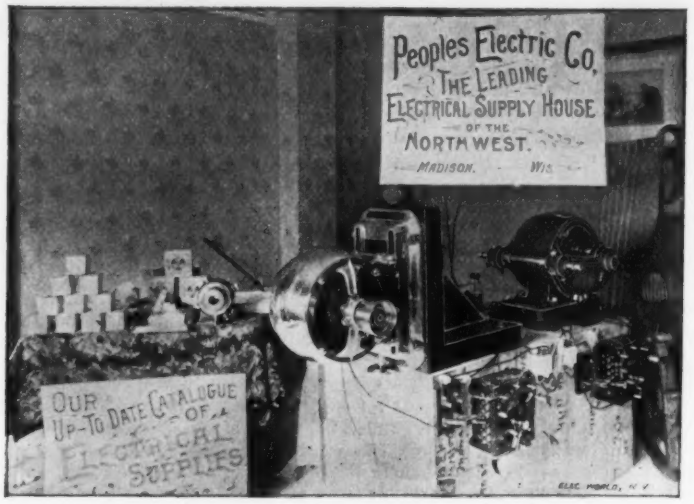
THE STANDARD PAINT COMPANY, New York, was represented by Mr. J. C. Shainwald, Western manager. Mr. Shainwald preached P. & B. products with much enthusiasm.

MESSRS. W. H. McKINLOCK AND W. C. CAMP, of the firm of McKinlock & Camp, Chicago, were both present at the convention.

THE TRIUMPH ELECTRIC COMPANY, Cincinnati, Ohio, was represented by its Chicago manager, Mr. A. W. Foster, who is a decided convention favorite.

THE PEOPLE'S ELECTRIC COMPANY, of Madison, Wis., had an exhibition of a very attractive line of specialties. The company was represented by Mr. F. H. Ford and C. W. Bacon.

THE NORTHERN ELECTRICAL MANUFACTURING COMPANY'S



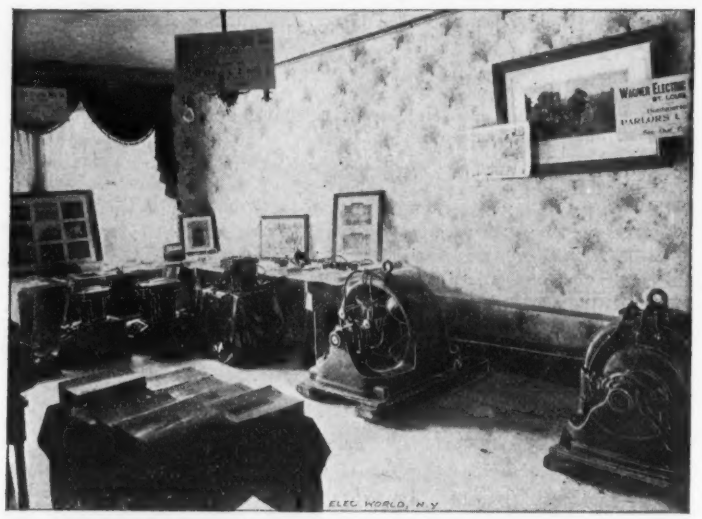
EXHIBITS OF THE PEOPLE'S AND NORTHERN ELECTRIC COMPANIES.

interests were looked after by its manager, Mr. A. O. Fox. This company's headquarters are at Madison, Wis. The company had an exhibit of some very handsomely designed and finished motors and generators, and Mr. Fox received many congratulations on his company's excellent work. These machines constituted one of the principal attractions of the convention.

THE STANDARD CARBON COMPANY, Cleveland, Ohio, was well represented by Mr. Wallace O'Connor, who worked "like a major" all the time. Judging from his manner, there is every reason to believe that he was capturing a great deal of business for his company.

MR. GEORGE W. PATTERSON represented the following named companies: The Gordon-Burnham Battery Company, New York; the American Circular Loom Company, Boston, and the Ohio Storage Battery Company, of Cleveland.

THE WAGNER ELECTRIC MANUFACTURING COMPANY, St. Louis, had a very attractive exhibit in Parlors 1, 2 and 3. A fine line of motors, transformers, direct-current switchboards, isolated plant switchboards, high-grade knife switches, alternating-current power motors, switchboard ammeters, volt-



THE WAGNER ELECTRIC MANUFACTURING COMPANY'S EXHIBIT.

meters and indicating wattmeters for alternating currents was shown. The company was represented by Mr. E. H. Abadie, general manager, assisted by Mr. J. H. Perkins and Mr. J. Holt Gates, of Chicago. An attractive calendar was distributed, on which were shown illustrations of the various specialties made by the company.

MESSRS. ROHN & MEYER, Milwaukee, Wis., exhibited a line of "Helios" enclosed arc lamps, and did some effective work in impressing upon delegates that this is the longest burning lamp on the market.

THE ELECTRIC APPLIANCE COMPANY, Chicago, was represented by Mr. W. W. Low, who is an immensely popular attendant at conventions. Mr. Low's numerous friends were eager to avail themselves of the opportunity to grasp his hand once more.

THE CLOOS ELECTRICAL ENGINEERING COMPANY, Milwaukee, Wis., had a notable exhibit of its safety and economical devices for high-potential currents. It included dynamo switches, single and double coupling

EXHIBIT OF THE CLOOS ELECTRICAL ENGINEERING COMPANY.

boxes, alternating and direct-current junction boxes, single branch cut-outs, etc. The primary or dynamo switch has been designed to overcome the difficulty of breaking alternating currents under load without danger. It may be used for feeders as well. The single wire plug cut-out coupling box is designed for direct-current series arc light underground circuits. It is said to be extremely simple, and the working parts work under an insulating oil. The two-wire plug cut-out coupling box is intended to facilitate the testing and repairing of alternating underground cable. The direct-current junction boxes for arc lights, it is stated, have been submerged in water for several months and operated without experiencing any difficulty whatever. They are designed for underground work. The company was represented by Mr. Jacob Cloos, vice-president; Mr. E. A. Wurster, secretary; and Mr. H. R. King, general manager. Mr. Herman W. Falk, of the Falk Engine Works, is president of the Cloos Electrical Engineering Company.

MR. JAMES C. WORMLEY represented the firm of James C. Wormley & Co., of Chicago. He exhibited the "Wormley" and "Shelby" lamps, ranging from 2 to 250 volts and from one-fifth to 50 candle-power. The exhibit consisted of seventy-five regular lamps, and about 100 miniature lamps, no two being

JAMES C. WORMLEY & CO.'S LAMP EXHIBIT.

alike. Mr. Wormley also exhibited filaments in their different stages of manufacture, showing the square-cut carbon made exclusively in this country by Prof. A. A. Chaillet, technical manager for the Shelby Electric Company, and squirted cellulose filaments. The latter were shown in various stages of development, namely, liquid thread, dried thread, carbonized and treated. The 3-watt, 220-volt lamps exhibited by this firm attracted a great deal of attention.

THE DUPLEX MANUFACTURING & ELECTRIC COMPANY, Chicago, was represented by Mr. L. M. Cole.

THE LESCHEN-MACOMBER-WHYTE COMPANY, Chicago, of "Hercules wire rope" fame, was ably represented by Mr. George S. Whyte, secretary of the company. This gentleman is one of the most popular business men connected with the Northwestern Association. He distributed a very attractive and neatly arranged book of poems, which was in great demand among the delegates.

THE BRYAN-MARSH COMPANY, of New York, exhibited a large line of its various types of incandescent lamps, together with samples of double filament type lamps of all candle-powers. The exhibit elicited the admiration of the visitors. The latest types of 220-volt lamps of this company, without any anchors, braces or coils, were also seen. Mr. Converse D. Marsh, president,

The Bryan-Marsh Company's Lamp Exhibit.

represented the company's interests. Mr. Marsh held the record for the longest journey made by a delegate at this convention. The exhibit was well looked after by Mr. Joseph I. Hill, the company's Western manager. Mr. Hill was kept busy, and reports receiving several noteworthy orders for lamps. Visitors were allowed to test the vacuum of lamps by the use of a spark coil which was provided for the purpose. The absence or existence of residual gases or vapors was clearly indicated by complete darkness, or the presence of a glow within the bulb of the lamp.

THE PERKINS ELECTRIC SWITCH MANUFACTURING COMPANY, Hartford, Conn., was well and ably represented by Mr. Edward J. Patton, who proved to be quite a favorite.

THE BRYANT ELECTRIC COMPANY, Bridgeport, Conn., was represented by the "Chesterfield" of the convention, Mr. Edward Grier, the company's Western manager, who is too well known to need any introduction here. "Bryant sockets" was his watchword, and as a salesman Mr. Grier is at the head of his class.

MR. JULIAN ROE represented the Crocker-Wheeler Electric Company, of New York, and never tired of giving it as his earnest belief that his company's motors and dynamos are unequalled anywhere.

THE J. M. ATKINSON COMPANY, of Chicago, manufacturer of rail bonds, was well represented in the person of Mr. Atkinson himself, who is an old-time convention warrior. This gentleman is a general favorite and an excellent business man.

MR. JAMES F. CUMMINGS, of the Armorite Company, Pittsburg, arrived at the convention just as the fish was being served at the banquet. He received a cordial reception, but owing to a business engagement, he was obliged to leave before the end. It was stated that he was interested in closing a very large contract in or about Chicago.

THE SAWYER-MAN ELECTRIC COMPANY, Allegheny, Pa., was represented by Mr. C. A. Ross, who had an eye open for business.

THE NATIONAL CARBON COMPANY'S interests were well taken care of by Mr. John Rice, of Chicago, who is such a hard worker that he thinks the days are not long enough. His friends say that he would rather work than eat.

THE GENERAL ELECTRIC COMPANY, as usual, had a large and comprehensive exhibit. It comprised the latest type of apparatus and instruments, among which were shown the direct-current magnetic blow-out lightning ar-

The General Electric Company's Exhibit.

resters, designed for use in circuits carrying 850 volts, and will take care of a lightning discharge of 8000 to 10,000. The new series arc cut-out and ceiling board were also shown. The arc lamps on exhibition included the carbon feed type, enclosed long-burning direct-current lamps; also the new long-burning alternating-enclosed lamp, with a life of about eighty hours. Wirts lightning arresters, as well as other types of General Electric Company's enclosed lightning arresters, were also exhibited. The exhibit included lamp inspectors' indicating wattmeters, which are described and illustrated on another page in this issue. The electrostatic ground detector and a line of inclined coil instruments were also displayed. The new direct-current stationary motor was connected and proved itself to be unique and interesting. The company was represented by Messrs. F. M. Boyer, J. Scribner and R. A. Swain, from the Chicago office, and Mr. Thomas Ferris, of the Milwaukee end.

THE AMERICAN ELECTRICAL WORKS, Providence, R. I., was well represented by Mr. Edgar H. Hammond and F. E. Donohoe, the latter being the Western manager. Mr. Donohoe is one of the best wire salesmen in the West, and has a large circle of friends. He had an enthusiastic reception on his arrival at the convention.

MR. H. J. GILLE, of St. Paul, Minn., represented the Washburn & Moen Manufacturing Company, of Worcester, Mass.

MR. A. B. CONOVER, JR., represented the John A. Roebling's Sons Company, of Trenton, N. J., and made many friends at the convention for that well-known wire manufacturing house.

THE CHARLES E. GREGORY COMPANY, Chicago, said to be the largest electrical second-hand bargain house in the world, was represented by Mr. Francis Raymond and General Manager A. Louis Kuehmsted. Two more popular men never attended a convention. They came willing and prepared to buy and pay cash for anything electrical, old or new, and never once lost sight of the fact that they represented a house that stood at the head in its particular line.

MR. L. W. KITTMAN, the old standby, looked after the interests of the Chicago General Fixture Company.

THE WESTERN ELECTRIC COMPANY, Chicago, was represented by Messrs. A. L. Tucker and Thomas G. Grier. These gentlemen distributed a very attractive card, announcing the fact that their Chicago office is now the headquarters for Okonite wires and cables, as well as Okonite and Manson tape.

THE DEARBORN DRUG & CHEMICAL COMPANY, Chicago, distributed, through its president, Mr. William H. Edgar, some handsome souvenirs, which were eagerly sought after. This company's boiler compound, oils and chemicals are evidently well thought of, as their merits were very freely discussed, and many complimentary things were said of them. The company was also represented by Mr. Charles S. Kehler, its Wisconsin agent.

THE COLUMBIA INCANDESCENT LAMP COMPANY, St. Louis, exhibited a full line of samples of regular and special lamps, including colored lamps; also, a special line of 220-volt lamps, all of which attracted much attention. The materials from which the lamps were made were also shown in va-

Display of Columbia Incandescent Lamps.

rious stages of manufacture. The company was represented by Mr. A. C. Garrison, secretary and treasurer; Mr. J. E. Randall, superintendent, and Mr. George R. Rex, the Chicago manager.

MR. MORGAN BROOKS represented the Electrical Engineering Company, of Minneapolis, Minn.

MESSRS. McGILL AND POMEROY, manufacturers' agents, Chicago, were represented by both partners.

MESSRS. LANGSTADT & CROSWELL, supply dealers, Appleton, Wis., were represented by Mr. A. C. Langstadt.

THE SAFETY INSULATED WIRE & CABLE COMPANY, of New York, was well represented by Western Manager M. B. Austin.

MR. A. O. SCHOONMAKER, New York, the well-known mica dealer, was very ably represented by his Chicago manager, Mr. John Child.

THE CROUSE-TREMAINE CARBON COMPANY and the Fostoria Incandescent Lamp Company, Fostoria, Ohio, were represented by Mr. John S. Maurer. The "Duplex" or double lamp attracted considerable notice.

THE HART & HEGEMAN MANUFACTURING COMPANY, Hartford, Conn., was represented by Mr. George S. Searing, Western manager, whose visits were always looked forward to by his numerous friends with the greatest of pleasure.

MESSRS. SARGENT, LUNDY & INSULL, of Chicago, were represented by Mr. T. E. D. Ritchie, an old-time favorite. Mr. Ritchie had an exhibit of a line of C & C dynamos and motors, Fort Wayne incandescent lamps and Paragon fan motors. Messrs. Sargent, Lundy & Insull are the general Western sales agents for the C & C Electric Company, of New York.

THE VARLEY DUPLEX MAGNET COMPANY, Jersey City, N. J., was represented at the convention by a well-selected exhibit of its specialties. The exhibit was in charge of Mr. J. Mason Knox, who took pleasure in explaining to the telephone men the merits of the Varley magnets. Mr. Knox will probably remain in Chicago for some weeks for the purpose of interesting telephone men in some important improvements the Varley Company has recently made in its specialties. John B. Farrington is also visiting telephone men in the West in the company's interests.

News of the Week

Financial Intelligence.

THE $1,000,000 5 per cent. collateral trust gold bonds of the Erie Telegraph & Telephone Company have been fully subscribed for.

THE EDISON ELECTRIC ILLUMINATING COMPANY of New York reports gross earnings for December of $286,740, an increase of $40,465 as compared with the same month of the previous year, and net $157,410, an increase of $24,491. For the year ending December 31 the gross earnings were $2,492,371, an increase of $244,933 as compared with the corresponding period of the previous year, and net $1,267,230, an increase of $172,880.

THE EDISON ELECTRIC ILLUMINATING COMPANY of Brooklyn reports gross earnings for December of $93,657, an increase of $11,497 as compared with the same month of the previous year, and net $46,605, an increase of $24,291. For the year ending December 31 the gross earnings were $2,492,371, an increase of $244,933 as compared with the corresponding period of the previous year, and net $1,267,230, an increase of $172,880.

Special Correspondence.

NEW YORK NOTES.

Office of THE ELECTRICAL WORLD,
253 Broadway, NEW YORK, Jan. 24, 1898.

JUSTICE SMITH, in the Supreme Court in Brooklyn, on January 17, vacated the assessment on the personal property of the Edison Electric Illuminating Company of Brooklyn. He says that if the assessors had deducted from the gross assets of the company the amount of capital invested in United States patent rights, as they should have done, there would have been no personal property to be assessed.

THE APPELLATE DIVISION of the Court of Appeals on January 19 entered the order of appeal in the action of William R. Hearst, proprietor of the New York *Journal* against the trustees of the Brooklyn Bridge, to prevent the construction of the railway loop at the New York terminus. No provision, however, was made for a stay of the proceedings in building the loop and operating the surface cars on the bridge. It is thought that a decision of the court will be rendered by the middle of February.

TELEGRAPH CABLE TO TURK'S ISLAND.—Mr. Geo. G. Ward, vice-president and general manager of the Commercial Cable Company, informs us that a submarine cable has been laid and is now open for business between Bermuda and Turk's Island (in the West Indies). The cable is owned and will be operated by the Direct West India Cable Company, working in connection with the Commercial Cable and Postal Telegraph Companies. The rate from New York City to Turk's Island will be 56 cents per word.

THE LONG ISLAND RAILROAD COMPANY'S PROPOSED RAPID TRANSIT SYSTEM.—On January 21 a bill was introduced in the Legislature at Albany to permit the Long Island Railroad Company to operate a street surface line on Atlantic Avenue, Brooklyn, after its present tracks have been put underground. The ultimate plans of the company contemplate the building of a tunnel under the East River, from the terminus of the Atlantic Avenue road to a point near Maiden Lane in New York, and an underground railroad from there up the West Side at least as far as Forty-second Street. The whole system would connect with the other lines of the company, and provide direct transportation from Forty-second Street through Brooklyn to Montauk Point.

THE HENRY ELECTRICAL SOCIETY on Friday evening, January 21, held a meeting in the new engineering building of Columbia University, Morningside Heights. Mr. D. R. Lovejoy gave an address on "The Induction Coil and High Potential Discharges," treating the matter entertainingly, first, from an historical point of view, discussing the improvements added by different designers; second, from the constructional point of view, discussing the difficulties of insulation, etc., and, third, from the point of view of the results obtained. Several induction coils embodying the speaker's own ideas and work were shown, the largest, which is in the laboratory of the university, being inspected after the meeting. This coil is capable of giving a 30-inch discharge. Experiments were performed showing effects with Geissler and Crookes tubes.

TROLLEY CARS ON THE BRIDGE.—On Saturday last two cars containing officials of the Brooklyn Heights Railroad Company were run over the bridge and around the loop at the New York end and back to Brooklyn. On Sunday regular trips were made on half hour headway during the day, carrying passengers. The work on the loops at the New York end has advanced far enough to permit the operation of a limited number of cars. The first passenger car to pass over the bridge on Sunday was of the Graham Avenue line, and on the front dashboard was the sign "Direct to New York." No difficulty was experienced, and it took about twenty minutes, including all stops and waits, to make a round trip. The cars, however, will not yet be put into regular service on the bridge, until the work of widening the roadway at the New York end has been completed. There was, as usual on such occasions, a scramble for the honor of being the one to pay the first fare.

A MEETING OF THE RAPID TRANSIT RAILROAD COMMISSION was held on January 17, at which the report of the committee on contract was received. The committee states that it was unable to find any contractor that could meet the conditions imposed by the Appellate Division of the Supreme Court, in requiring a $15,000,000 bond to secure the construction and operation of the proposed underground road. It recommends that the commission shall not advertise for bids for the construction and operation of the road until the board learns the extent to which the Manhattan Elevated Railway Company proposes to meet the demand for rapid transit. The report was accepted, and a resolution was adopted, inviting from the president of the Manhattan Railway Company an early presentation of any application for additional facilities or extensions which that company may now desire. Another resolution was passed authorizing the counsel of the board to petition the Appellate Division of the Supreme Court for some modification of the recent decision relative to the $15,000,000 bond.

EXPOSITION IN LONDON.—We have received from the London Exhibitions, Limited, a copy of its prospectus of the "Universal Exposition," which will be held at Earl's Court, London, from May to October, this year. It is the object of the exposition to illustrate the latest achievements in inventions, manufactures, industries and applied arts, and important sections will be devoted to the largest manufacturing and producing countries of the world. It is confidently expected that American producers and manufacturers will avail themselves of this opportunity to extend their business. The prospectus states that the best location of the exposition has been reserved to the United States department, and no pains will be spared by the management in order to afford every facility to American exhibitors. Mr. Imre Kiralfy is managing director of the exposition, and Mr. A. Macchi, who was a member of the board of judges at the World's Exposition at Chicago, in 1893, has been appointed commissioner for the United States. All communications relating to the exposition should be addressed to Mr. Macchi, at the exposition grounds, Earl's Court, London, S. W.

NEW ENGLAND NOTES.

Branch Office of THE ELECTRICAL WORLD,
Room 91, Hathaway Building, 620 Atlantic Ave.,
BOSTON, Mass., Jan. 22, 1898.

THE BERNSTEIN ELECTRIC COMPANY, 355 Congress Street, Boston, made an assignment January 20, to Benjamin F. Peach, Jr., as trustee for the benefit of the company's creditors.

THE MASSACHUSETTS SENATE has just refused to confer with the House in referring to the committee on railroads a general bill allowing steam railroads to construct electric street railways in the highways of the commonwealth, and referred the bill to the committees on street railways and railroads sitting jointly. This bill vitally affects the interests of electric and steam railways.

MR. G. A. NISBET, general manager of the Electrical Appliance Company, of New York, was a recent visitor to Boston, and accomplished some fine business results for the Gravity motor controller, the specialty manufactured by his company, and for which its New England agents, the L. A. Chase & Co., have done a nice business. Mr. Nisbet is a wide-awake business man, and possesses precisely the business and social characteristics to win favor for his company.

UPTON ARC LAMPS have been installed in the Pennsylvania State College, and have received an excellent tribute from the *Free Lance*, published in the interests of the college, as follows: "The Upton lamps were selected on the strength of results obtained by a long series of tests with his class of lights. The tests covered a period of from four to five months, and the experts in charge of the tests say they showed the Upton to be more economical and give a steadier light with less attention, expense and repair, than any with which it was compared." The lamp referred to is the regular Upton "Midget," 110-volt lamp, manufactured by the Standard Thermometer & Electric Company, of Peabody, Mass.

THE J. M. CARPENTER TAP & DIE COMPANY, of Pawtucket, R. I., has just issued a new catalogue, No. 12, which will be found of much practical interest and value to users of taps and dies, as well as threading tools. Exceeding care is evident in its arrangement, and its compactness and pocket size will make it doubly acceptable to the mechanic, as well as to dealers in these goods. About 5000 sizes and kinds of screw cutting tools are to be found listed in this book in an admirable manner, with excellent cuts of everything listed. The company will send a copy of this catalogue to every reader of THE ELECTRICAL WORLD on application.

THE BOARD OF RAILROAD COMMISSIONERS of Massachusetts has just sent to the Legislature its annual report, which shows for the steam roads quite a decrease in gross earnings and passenger traffic, the amount reaching about $3,000,000. The commissioner does not pretend to state whether the cause of this is the hard times or street railway competition, but suggests the shrinkage as a subject for careful thought and study. Discussing the use of electricity in railroad operation, and particularly what has been done in that line by the New York, New Haven & Hartford, the board says: That the practicability of the use under favorable conditions of a third rail for the transmission of electric current on surface roads (contrary to the then generally accepted opinion of electrical experts) is perhaps the most important fact of more recent demonstration. The third rail has manifest advantages in point of practical convenience over the overhead trolley. The board adds that it has not yet been put to the test of all of the possible vicissitudes of a New England winter. Some changes in the existing railroad laws may have to be made in reference to the use of electricity.

THE LIBERTY LAMP COMPANY, manufacturers of incandescent lamps, Boston, is a new candidate for public favor, but its management is by no means new to the electrical field—Mr. Eugene McOuat and Mr. W. W. Scott, both of whom are well and favorably known. Mr. McOuat has had long experience in incandescent lamp manufacture, going as far back as 1879, with the United States Company, following which he had prominent connections with Edward Weston, the Westinghouse Electric Company, at Pittsburg, the Sawyer-Man Company, and more recently for several years with the Beacon Lamp

Company. Mr. Scott has also had considerable experience, principally, however, with the Beacon Company, with which he was identified for a number of years, making hosts of friends in the electrical trade. The Liberty Lamp Company is located in the Harcourt Building, Irvington and Harcourt Streets, Boston, the same building in which the Beacon Company was so long located. The company is now ready to introduce itself for business, and the reputation of Mr. McOuat and Mr. Scott would seem sufficient to guarantee an excellent quality of incandescent lamps. Its manufacturing department and facilities are first class in every respect.

THE ARMINGTON & SIMS COMPANY has just purchased the business and assets of the old Armington & Sims Engine Company, Providence, R. I. As the Armington & Sims engine was the first engine designed for use in connection with electric lighting, readers of The Electrical World will be glad to know that the manufacture of this old and well-known engine is to be perpetuated. The business of the company was very profitable until within a comparatively short time ago, when internal dissensions created friction among the officers, and with a view to the settlement of the difficulties the company made an assignment. For the past year or so the business has been conducted by a creditors' committee, under the management and supervision of Mr. Fred. N. Bushnell, a well-known mechanical engineer, whose work has given him more than a local reputation, and although no real effort has been made to obtain orders, the business has actually been conducted at a profit. An entirely new company has just been formed, which has bought out all the old interests and purposes hereafter to push the business vigorously. All of the engines will be manufactured under the personal supervision of Mr. Bushnell, for many years prominently identified with the Providence Steam Engine Company, and for the last five years consulting engineer of the Narragansett Electric Lighting Company, in Providence. Everything connected with the placing and operation of the engines in the station of the Narragansett Electric Lighting Company has been and is under Mr. Bushnell's direction, and anybody who has visited the station will ask for no better recommendation as to his ability as an engineer. During the last year the Armington & Sims engine has been much improved, and the 1898 type will be found considerably different from that first offered electric lighting companies. Among the new features may be mentioned a double-ported cylindrical piston-valve, with self-adjusting rings, new self-oiling bearings, Rites inertia governor, etc. The officers of the new company are: President, Julius Palmer, president of the Old National Bank, in Providence; secretary and treasurer, Mr. James C. Church, well known in banking and general business in Providence; general manager, Mr. Fred. N. Bushnell. The company is organized under the laws of Rhode Island, with a capital of $150,000. It starts in business without debts and with ample working capital. Mr. W. F. Haring, so well known in connection with the agency of the old company in New York State, New Jersey and Pennsylvania, will continue to represent the new company in the same territory. We feel sure that the readers of The Electrical World will join us in cordially wishing success and prosperity to the reorganized Armington & Sims Company, and to Mr. Bushnell, upon whom will devolve the active management of the business.

PHILADELPHIA NOTES.

Branch Office of THE ELECTRICAL WORLD,
929 Chestnut Street,
PHILADELPHIA, Pa., Jan. 22, 1898.

MESSRS. EYANSON & ARMPRIESTER have removed their headquarters to the Large Building, on Commerce Street, corner of Seventh, this city. The firm's constantly increasing business made this change necessary. The new quarters are much larger and facilities for handling work much increased. The company still manufactures the high grade knife switches which have given it the reputation it enjoys.

A NEW COMPANY, with a capital of $15,000,000, is in process of formation to buy the control and to consolidate the management of the electric lighting companies in Philadelphia, outside of the Edison-Pennsylvania Company. The plan is not thoroughly matured as yet, but eventually it will probably effect the consolidation of all the lighting interests in the city. The promoters are said to be closely associated with the United Gas Improvement Company which recently leased the gas works of the city. The project contemplates the issue of $15,000,000 debenture bonds at 5 per cent. in exchange for the capital stock of the companies, the preferred stockholders of the Pennsylvania Heat, Light & Power Company to receive bonds in the ratio of 66 2-3 per cent. of the par of their holdings, and the common stockholders 24 per cent.

THE ANNUAL MEETING of the Franklin Institute was held on January 19. A report on the tests of the synchronograph on the telegraph lines of the British Government was submitted by Dr. Albert C. Crehore and Lieut. George O. Squier. This report has just been transmitted to the Postmaster-General of the United States. It describes in detail the experiments made under the direction of Mr. William H. Preece, engineer in charge of the British postal system, in operating the Wheatstone instruments by the alternating current, according to the synchronograph method devised by Messrs. Crehore and Squier. The results announced are both interesting and important. At the stated meeting of the electrical section of the institute, which will be held on January 25, Mr. Louis G. Rowand will read a paper on "Magnetic Ore Separation."

SOUTHERN NOTES.

WASHINGTON, D C., Jan. 22, 1898.

AT ITS LAST SESSION the Board of Aldermen at Richmond, Va., concurred in the action of the Council in allowing the franchise of the Home and Southern Electric Companies to run thirty years instead of thirteen years.

NEW TELEPHONE COMPANIES CHARTERED.—Charters have been granted to the Lexington, Va., Telephone Company, with a capital stock of $5000, and the Rockbridge, Allen, Longdale & Lexington Telephone Company, with a capital stock of $5000.

THE SPOTTISWOOD TELEPHONE COMPANY, which runs between Lexington and Staunton, Va., is stringing a third wire between the two places named, and putting in a new switchboard at Raphine, Va. The company is also running many short lines to various towns in the county.

REPRESENTATIVE POWERS, of Vermont, has introduced a bill in the House providing for the regulation of the charges for the use of telephones in the District of Columbia. The bill provides that after July 1, 1898, no company in the District shall charge more than $25 a year for a telephone in a private house; $35 for an instrument in a business house, and $50 for a hotel telephone. A penalty of $250 for each offense is provided.

THE NORTH CAROLINA RAILROAD COMMISSIONERS have made a sweeping reduction in the rates for the annual rental of telephones in that State by ordering the following charges to be made on and after February 1 next: Business telephones, special wire, $30; two and three-party wire, each, $24; four and five-party wire, each, $18; residence telephones, special wire, $18; two and three-party wire, each, $16; four and five-party wire, each, $14. These rates do not apply to service outside the corporate limits of any city or town. The Southern Bell Telephone Company has filed objections to the order, alleging that the present Board of Railroad Commissioners is not a legal one.

THE NEW ELECTRIC CARS that are being run on the Fourteenth Street branch of the Capital Traction Company's system in this city are the handsomest ever seen in Washington. The upholstering is of the highest class, and the seats are higher than usual and more comfortable. They are the same length as those used on the Metropolitan road, but higher and wider. They are fitted with Farmenter fenders, both at the front of the cars and on the wheel guards. The punch system of recording fares will be abolished in favor of registers placed overhead inside of the cars.

THE DISTRICT COMMISSIONERS are about to institute an investigation by electrical experts of their own selection of the Brown underground electric system, which is in operation on the Eleventh and N Streets' branch of the Capital Traction Company. The permit of ninety days granted by the commissioners for the operation of the road on this system has about expired, and while it is claimed by the projectors of the system that it is a success, the commissioners have determined to settle this point for themselves, and will have an expert examination made as above noted.

AMONG THE BILLS recently introduced into Congress, of electrical interest, is one by Mr. Wheeler, of Alabama, providing for the establishment of a Morse Memorial Conservatory of Electricity. The bill also provides that the Commissioner of Promotion having the matter in charge procure from each State by public or private contribution a fund sufficient to provide one perpetual free scholarship in the conservatory. A bill was also introduced in the House authorizing the United States Electric Light Company to lay underground conduits on the even numbered streets of the city, and the Potomac Electric Power Company to use the odd numbered streets. The District shall have the use of the ducts in the conduits.

A PROJECT is on foot at Atlanta, Ga., which, if consummated, will result in the installation of a plant second only to that at Niagara. A company of New York and Pennsylvania capitalists has, it is stated, acquired control of the Chattahoochee River for 16 miles, from Jones' Shoals to Powers Ferry. They have taken options on land valued at $175,000, including three shoals which will develop 11,000 horse power. Col. H. H. Berry, of Gainesville, Ga., representing the capitalists, has filed an application for a charter for the Atlanta Water Power Company, and its agent, Col. Cook, an English engineer, is expected to arrive soon to begin active work on the development of the water. It is the purpose of the company to furnish electrical power for manufacturing machinery placed along the line of the Southern Railway from Atlanta to Norcross. The distance to be covered by the transmission line is 75 miles, and it is understood that at least one million dollars will be invested in the enterprise.

BUFFALO AND NIAGARA FALLS NOTES.

BUFFALO, N. Y., Jan. 22, 1898.

A FIGHT HAS DEVELOPED in the race to control the trolley lines to be run in connection with the Pan-American Exposition. The Niagara Falls road has applied for permission to build a new cross-town line to connect with the Ely road southward. This is the route selected by the Tonawanda Company, and is supposed to be intended to forestall the latter's plans.

THE NIAGARA POWER COMPANY announces that it has closed the bargain with two large concerns that are to locate at Niagara Falls and derive their power from the company. At present it declines to give their names. One is said to be the Canadian firm of Alexander Morton & Co., carpet manufacturers. The two, it is said, will bring 1000 people with them.

THE TONAWANDA CITY TROLLEY LINE was sold at auction last Saturday on a foreclosure of the claim of the Michigan Pipe Company, of Bay City. It was bought by Henry B. Smith for $50,000, and will be reorganized. This means that it has been allowed to go to sale for certain purposes best understood by the former owner, who will now push it forward and build a complete line from Buffalo to Niagara Falls.

A NEW ELECTRIC ROAD has been projected from Lewiston to the Pan-American Exposition grounds at La Salle. The distance is about 10 miles, and the line will parallel the Gorge road and the Buffalo & Niagara Falls road to Cayuga Island, the site of the exposition. It is said that New York capital is in the venture. The line will not follow the Niagara River, but will run inland to take in Pletcher's Corners, in order to obtain a favorable route. The patronage is expected to come from the lake travel between Lewiston and Toronto.

THE CATARACT POWER & CONDUIT COMPANY, of Buffalo, has ordered of the Westinghouse Electric & Manufacturing Company, of Pittsburg, eleven new transformers of the step-down type, which are to replace the temporary ones now in use in the new transformer house on the water front.

The manufacturers agree to have them on the spot in eighty-five days. They will have a capacity of 2700 kilowatts, and will reduce the pressure of the current from the Niagara tunnel from 11,000 to 2200 volts, at which pressure the company proposes to deliver it to all customers. Anyone wishing less than 75 horse-power or a further reduction of voltage will obtain it of the Buffalo General Electric Company.

PITTSBURG NOTES.

PITTSBURG, Pa., Jan. 21, 1898.

DIVIDEND DECLARED.—The directors of the Central District & Printing Telegraph Company have declared a quartely dividend of 2 per cent., payable on January 31, to stockholders of record on January 26.

CAR WHEEL COMPANY CHARTERED.—On January 15 a charter was issued by the State Department at Harrisburg to the Pennsylvania Car Wheel Company, of Pittsburg, the organization of which was previously announced in THE ELECTRICAL WORLD. The capital stock is $100,000. The incorporators are: Joshua W. Rhodes, of Allegheny; William L. Elkins, James D. Rhodes, of Pittsburg; and Charles Slocum and Alexander W. Slocum, of Buffalo, N. Y.

ENGINEERS' SOCIETY ELECTS OFFICERS.—On January 18 the Engineers' Society of Western Pennsylvania held its annual meeting. The new officers elected are: G. S. Davidson, president; W. A. Bole, of the Westinghouse Machine Company, vice-president; C. F. Scott, of the Westinghouse Electric & Manufacturing Company, and Gustave Kaufmann, directors; R. A. Fessenden, of the Western University, secretary, and A. E. Frost, treasurer. The annual banquet of the society will be held next week.

CITY SUES TRACTION COMPANIES FOR BRIDGE TOLLS.—Three suits have been entered in Common Pleas Court No. 1 in behalf of the city against street railway companies to recover tolls for the use of bridges belonging to the city. Two of the suits are against the Pittsburg & Birmingham Traction Company, one amounting to $6300, alleged to be due for use of the Smithfield Street bridge, and one amounting to $8750, for use of the Tenth Street bridge. The third action is against the Pittsburg & West End Passenger Railway Company for its use of the Point bridge. The amount of this claim is $12,666.66. These suits are a result of the recent decision of the Supreme Court, previously announced in THE ELECTRICAL WORLD, in the case of the Pittsburg & Birmingham Traction Company against the Monongahela Bridge Company. The real defendant in that case was the city, and the decision was in its favor.

VETO OF UNITED TRACTION ORDINANCE SUSTAINED IN ALLEGHENY.—The fight that has been waged for many months in the Allegheny City Hall, over the ordinance granting a 999-year franchise to the United Traction Company, ended last night in the defeat of the ordinance. The Mayor's veto of the ordinance had been overruled in Select Council the night before, by a close vote. The popular interest in the final struggle in Common Council was indicated by the crowd of citizens who thronged the lobby and hallways, and cheered the proceedings at frequent intervals. Several speeches in favor of the ordinance were made, the speaker in each case, however, announcing that he would vote against it, in deference to the demands of his constituents. The final vote in favor of sustaining the Mayor's veto was, therefore, unanimous. The chief points that were objected to in the ordinance were the absence of a provision requiring free transfers to be issued, and the fact that the franchise conferred by it was practically perpetual, with no means of modifying it under changing conditions. The United Traction Company, for the present, at least, must continue to operate under the franchises granted to its underlying companies.

CHICAGO NOTES.

Branch Office of THE ELECTRICAL WORLD,
986 Monadnock Building,
CHICAGO, Ill., Jan. 22, 1898.

AT A MEETING OF THE ENGINEERS' CLUB of Chicago on the evening of January 28, Mr. Edward B. Ellicott will give a lecture on fire alarm systems. On the 29th the club will visit the electrical power plant of the Western Wheel Works. An invitation to be present at these meetings is extended to all interested.

MR. W. R. GARTON, for nearly four years in charge of the railway department of the Central Electric Company, Chicago, has severed his connection with that company and will hereafter give attention to his personal business interests. Mr. Garton is widely known as the inventor and manufacturer of the Garton lightning arrester. Mr. Garton has the agency for several leading electrical specialties, and no doubt will enjoy a deservedly successful business.

THE CHICAGO ELECTRICAL ASSOCIATION has just issued its spring programme of meetings. On February 4 a paper will be read by Mr. C. C. Mattison, entitled "Electricity in Shipbuilding." "Electricity in Medicine" will be considered on February 18, by Mr. E. W. Jewell. On March 4, Mr. A. Miller Belfield will read a paper on "The Relationship of the Hunter and Tesla Patents." "The Autobiography of a Piece of Wire" will be given by Mr. C. T. Gage, on March 18, and on April 15 "The Electric Railway" will form the subject of a paper by Mr. W. R. Garton. On May 6 "The Enclosed Arc Lamp" will be discussed by Mr. J. M. Hollister, and on May 20 the annual banquet will be held.

MILWAUKEE NOTES.

MILWAUKEE, Wis., Jan. 21, 1898.

MR. JOHN G. HARSHBERGER has been granted a franchise to establish and run an electric light plant in Lancaster, Wis.

THE WATER, LIGHT & POWER COMPANY, West Superior, Wis., is taking out sixty of the arc lamps used for city lighting. The city thinks there is plenty of light without them.

THE FOX RIVER LIGHTING COMPANY has been incorporated at Green Bay, Wis., with a capital stock of $15,000. The company will do a general lighting business in this city.

THE FOX RIVER VALLEY INTERURBAN RAILWAY power house will very likely be located at Neenah, Wis. The officials of the road have been negotiating for a plot of land near the dam.

THE SOUTH MILWAUKEE ELECTRIC LIGHT & POWER COMPANY has been transferred to Mr. H. M. Green. This ends the movement to declare the lighting franchise of the company invalid on account of the failure of the company to comply with the provisions of the charter for a bond and for extensions of the lines when ordered by the council. It is expected that the service will be greatly improved.

ST. LOUIS NOTES.

ST. LOUIS, Mo., Jan. 20, 1898.

THE MACON CITY TELEPHONE SYSTEM was sold to a local syndicate yesterday, which will at once incorporate with a capital of $10,000.

AN ELECTRIC RAILWAY from East St. Louis to Vincennes is planned. Right of way petitions are now being circulated. The route parallels the B. & O. S.-W. Railroad, and is projected by the Wabash & Mississippi Construction Company.

KINLOCH TELEPHONE LINEMEN STRIKE.—The linemen working for the Kinloch Telephone Company are on a strike. The police are protecting those men working, and there is every probability of satisfactory arrangements being made to bring the trouble to an end.

A CHATTEL DEED OF TRUST was filed Friday by the Missouri Telephone Manufacturing Company, transferring the effects of the company to Ben W. Lewis, trustee for the Third National Bank, and other creditors, whose claims amount to $5,499.30. The bank's claim is $500, other creditors and claims mentioned are: J. D. Perry Lewis, $3000; American Electric Works, Chicago, $225.93; Western Electric Supply Company, St. Louis, $324.73; Holtzer-Cabot Electric Company, of Boston, $611.49, and others, for small amounts. The assignment is not a failure, but an expeditious way of closing out the Missouri Telephone Manufacturing Company's business, as it has sold its good will and its stock on hand to the Central Electric Company, and is going out of business.

TEXAS NOTES.

SAN ANTONIO, Texas, Jan. 17, 1898.

A TELEPHONE LINE IS BEING CONSTRUCTED BETWEEN Llano, Tex, and Johnson City, Blanco County, Tex.

AN ELECTRIC LIGHT PLANT is being established for the town of Llano, Tex., by the Llano Water, Light & Power Company. The plant will be completed and placed in operation by the middle of February.

THE POSTAL TELEGRAPH COMPANY has secured right of way along the International & Great Northern Railroad from Taylor, Tex., to Laredo, passing through this city. An office of the company will be opened here for the sending and receiving of messages in about one month.

MEXICAN NOTES.

MONTEREY, Mexico, Jan. 17, 1898.

A NEW TELEGRAPH WIRE is being put up by the Mexican National Railway Company between Laredo, Tex., and the City of Mexico. The cost of the improvement will be about $75,000. The work is in charge of Mr. F. Robb, chief lineman for that road.

THE CONTRACT recently entered into between the National Department of Communications and Public Works of Mexico and Samuel Brothers, of the City of Mexico, for the purchase of all telegraph materials for the use of the Government, such as wires, instruments and poles, has been approved by President Porfirio Diaz. The contract amounts to $800,000 per annum. The price of each lot of goods is to be agreed upon between the department and the firm in question. This contract is of importance to United States firms, who have heretofore furnished the Mexican Government with these supplies.

THE MEXICAN GOVERNMENT has just opened a school in the City of Mexico for the training of boys and girls to be telegraph operators. For the present only sixty pupils will be received, but it is the intention of the Government to enlarge the school as soon as it is found practicable to do so. During three hours of each day the school is open for practical work, and messages are sent to the following places for 20 cents for ten words, and 2 cents for each additional word: Acapulco, Chilpancingo, Iguala, Libres, Salamanca, Tantoyuca, Aguas Calientes, Dos Arroyos, Irapuato, Otumbo, Silao, Taxco, Atotonilco, Encarnacion, Jalapa, Ozuluama, San Juan del Rio, Celaya, Guanajuato, Lagos, Puente de Ixtla, Tepeji del Rio, San Marcos, Yianguistengo, Cuernavaca, Huejutla, Leon, Queretaro, Tampico and Vera Cruz. This Government school is under the direct charge of Senor A. M. Chavez, manager of the Federal Telegraphs.

PACIFIC COAST NOTES.

SAN FRANCISCO, Cal., Jan. 15, 1898.

THE GENERAL ELECTRIC COMPANY has been awarded all of the contracts for electric apparatus for the Spreckels Beet Sugar Company's factory in Salinas, Cal. The last contract to be let was that for the switch-

board, which consists of four generator panels, five 1500-ampere feeder panels and eight 1000-ampere feeder panels.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY has been doing a flourishing business in supplies and small generators and motors. Many inquiries are received by the company regarding projected electric power plants for mines. A 37½-kw Westinghouse generator was recently sold to the Fulton Engineering Works for lighting purposes.

WATER WHEELS FOR FOREIGN COUNTRIES.—Among the recently filled contracts of the Pelton Water Wheel Company, San Francisco, are: A 1200-hp wheel and governor for an electric transmission plant in Petropolis, Brazil, this being a duplicate of the original plant; wheels for an electric transmission plant of 2000-hp capacity for San Rafael Paper Mills, Mexico, complete with governor and accessories; wheel for 100-hp electric lighting plant in Frujillo, Brazil; wheels for electric lighting plant in Tokio, Japan; two wheels for operating a mill near Tasmania, New Zealand; water wheel and transmission for operating tea estate, in connection with electric transmission, in Java; 200-hp wheel for electric transmission, to be used by the Jumper Mining Company, in Tuolumne County, Cal.; three wheels mounted on one shaft for driving generator for the Power Development Company, Bakersfield, Cal.; three wheels of 1000 horse-power each, directly connected to Stanley generators, for the Yuba Power Company, Marysville, Cal.; complete wheel and pipe system for operating the Republic Gold Mining & Milling Company's mill, near Spokane, Wash.; 200-hp wheels for operating the mill of the Dexter Gold Mining Company, Tuscarora, Nev.

Canadian Notes.

THE STREET CAR SYSTEM of Moncton, N. B., has not been a financial success, and the directors of the company have decided to discontinue the service during the winter months.

MR. J. B. McWILLIAMS, of Peterboro, Ont., is said to have interested English capitalists in the water power of the Otonabee River, and as a result a company may be formed to develop the power.

THE SHAWENEGAN MANUFACTURING COMPANY has asked for letters of incorporation, with a capital of $500,000. Its object is to develop the water power of the St. Maurice River, in the province of Quebec, for the production of calcium carbide and electricity.

THE CONTRACT for the power transmission plant of the British Columbia Railways Company at Victoria, B. C., has been awarded to the Canada General Electric Company, and will consist of three-phase generators, direct-connected to Pelton water wheels, having an aggregate capacity of 1500 horsepower.

BY A DECISION of the Supreme Court of Nova Scotia on January 15 the act by which the Sabbath Observance Society sought to stop the operation of the electric street cars on Sunday was declared to be *ultra vires* of the Provincial Legislature. The society had officers of the Halifax Electric Tramway Company summoned to the police court for employing men to perform servile labor on Sunday.

A BILL PASSED THE ONTARIO LEGISLATURE at its recent session which is regarded as being somewhat of an innovation. It provides that the city of St. Thomas, Ont., shall guarantee the Street Railway Company's bonds to the amount of $50,000, to enable the company to adopt electric power on its street railway system. In the event of the company failing to keep up its payments on the bonds, the city is permitted to take over the road and operate it. Hon. Mr. Gibson, Commissioner of Crown Lands, in referring to the bill, stated that the provision for municipal operation was something that had never been introduced into the Legislature before, but he believed that, in the modern view, such powers were proper ones to bestow upon the municipality.

English Notes.

(From Our Own Correspondent.)

LONDON, Jan. 5, 1898.

A REVIEW OF THE YEAR 1897.—Writing at the commencement of the new year it occurs to me that your readers might prefer to have a review of electrical progress on this side of the Atlantic during the past year, rather than the usual news notes. Although not directly an electrical event, the Diamond Jubilee of Her Majesty the Queen should receive first attention. Electrical engineers may regard this event as an expression—among other things—of the progress in electrical science and industry during the Victorian era. Appropriately, therefore, a part of the ceremony consisted in the cabling of Her Majesty's message to all parts of the earth where the British flag flies, and the return of the loyal messages from the colonies and other British possessions. The event which stands out most conspicuously, next to the Jubilee, is one of a darker shade; I refer to the engineering strike. During the latter part of the year the engineering trades of this country have been seriously impeded, and in some instances almost paralyzed, by the persistent and resolute conflict between the employers and employed. The vital point at issue seems to be a demand for a forty-eight-hours' week on the part of the men, the employers' contention being that such a demand would be fatal to all prospect of making a profit in the engineering industry. Unfortunately this gloomy conflict offers no immediate prospect of coming to a termination, but rather appears to grow darker. In the development of the electric supply industry in this country the trend in the direction of municipalization has been emphasized, the majority of new stations having been started under the control of local authorities. Among these I may mention Harrogate, Wallasey, Wakefield and Torquay, while within the metropolitan area a municipal station has been opened at Hammersmith. In electric traction the two concerns of chief importance which have been put into operation are the trolley lines at Leeds and Dover, both of which are operated under municipal control. The former has its own power house, but the latter is supplied with power metered from the power station of a limited liability company. Although the number of electric tramways opened during the year has been small, there are a great number in process of construction which promise to start operations early in the new year, while an enormous number of schemes for electric traction surface lines are projected. Another feature in the electric traction development of the year has been the progress made with the underground electric lines in London. The Waterloo & City line is now nearly completed, and, it is stated, will be opened in the course of a couple of months, while the tunnelling work of the Central London Railway is also nearly finished, and the equipment of the line will shortly be commenced. Your readers will be interested to learn that not a little of the electric traction carried on in this country during the last year has been backed by American enterprise, and a great deal of American plant has been sent over. We on this side look upon this state of affairs as transitory, and have good reason to believe that when the amount of electric traction work has grown a little our own contractors will awake to the necessity for action, and will standardize a complete set of electrical plant. Electric traction on common roads has gone ahead wonderfully during the past twelve months. A number of electric cabs have been running about the streets of London plying for hire, and, I understand, are working very successfully, both from an engineering and commercial point of view. The electric omnibuses promised at the beginning of the year have not yet started public work, though at the close of the year the promise has been renewed, and it is stated that one of the 'buses has already been licensed. In telephone work the most important events have been the completion of the taking over of the system of trunk lines by the post-office. Last October an inquiry was held in Glasgow with a view to decide whether the local telephone system should be acquired by the City Council. This matter has not yet been decided. The Yorkshire town of Huddersfield is also ambitious to have a municipal telephone system. In matters telegraphic a great deal of activity has been displayed in the perfecting of systems of "wireless telegraphy," though no commercial success has yet been attained in regard to signalling over long distances. Regarding submarine telegraphy, perhaps the most important mater has been the proposal which was placed before Her Majesty's Government last November for an "all-British" cable to Australia via the Cape of Good Hope. On the whole, a review of the year's progress in electrical science and engineering shows that considerable advance has been made, and there is every prospect of a prosperous and satisfactory continuance of this state of affairs during the year just begun.

French Notes.

(From Our Own Correspondent.)

PARIS, France, Jan. 1, 1898.

LIGHTING IN PARIS.—Notwithstanding the report of Mr. Charles Bos, which I mentioned in my letter of two weeks ago, the Municipal Council has just refused to prolong the franchises of the electric light companies. As to what the result of this action will be no definite prediction can be made, and it is hardly worth while to present here useless conjectures upon the subject.

THE ELECTRIC LIGHTING OF THE PALAIS DE JUSTICE.—Electricity is about to make its first appearance in the Palais de Justice at Paris. The work of wiring the building with the necessary material will cost about 200,000 francs ($40,000), Current will be taken from the electric light station on the left bank of the Seine. In the Palais lights will be installed in the departmental and city offices and court rooms, the Government offices and in various other places. The Prefecture of Police and all its various offices, including the municipal laboratory, will also be supplied with electric lights.

ELECTRIC TRACTION IN PARIS.—As was predicted in a recent communication, the Municipal Council of Paris has given one of its late sittings to the consideration of traction in the city, and plans for its coördination with the various suburban lines. The best and most easily feasible plan, as well as that which can be most quickly carried out, is the establishment of various electric tramways through the city. Despite its efforts, it does not appear that the Council has yet adopted a very determinate plan. This indecision will certainly be prejudicial to the rapid amelioration of the existing state of things which everybody in Paris wishes to see begun and carried to a successful termination. Two points, however, concerning tramways have been settled—the 10 centime (2 cents) fare, and the exclusive use of electricity as motive power, but the distance covered by this fare and the method of operation by electricity are both are yet to be ruled upon. As to the question of fare, it is whether the 10 centime fare, coming after that of 30 centimes, should correspond to a determinate distance, as from the suburbs to the centre of the city, for example, or be good for transit entirely across the city. As to the method of electric traction, the deliberations have energetically inveighed against the trolley, as I have mentioned in a former letter. There remain only the accumulator and the various methods of surface contact closed conduits systems. These latter methods seem the more promising, and some of them give excellent results. If the Claret Willeumier system, installed upon the line between the Place de la République and Romainville, has not shown all that was expected of it, the difficulty seems to be due mostly to the delicacy of the apparatus employed. There are other systems, however, such as the Westinghouse, Dialto, etc., upon which serious experiments have been made. Before their definite adoption, however, their employment upon all, or certainly upon a part, of the lines in the suburbs of which some are under contract and should be completed in a few months, can be predicted. The line from St. Germain to Clamart is an example. Meanwhile, although this method finds its followers, it may be said that its application is not altogether likely, for the Compagnie Francaise Thomson-Houston, which is building a part of the Clamart line, will adopt the overhead trolley, and it is only in Paris proper that the surface contact system will be used, if at all. It can be seen from this hurried survey of the situation that the Parisian tramway projects are still vague, and that many difficulties and many conflicts of interest will be encountered at the last instant to retard still further the application of electric traction in this city.

THE MANUFACTURE OF "AMBROINE."—Until very recently ambroine was only manufactured in Germany, where its employment has rapidly ex-

tended. The French company recently organized at Paris has built, at Ivry sur Seine a fine shop, occupying an area of about 50,000 square feet. Ambroine seems to be taking an important place among new insulating substances, not only in electrical construction but also in various other industries. In its composition fossil resins, mica, etc., enter in various proportions, according to the desired quality of product. The paste composed of these ingredients is forced into steel moulds, and subjected simultaneously to heat and considerable pressure. Objects thus moulded possess perfect homogeneity and remarkable stability. Some properties of ambroine merit attention. It has the advantage of being easily and sharply moulded without loss of volume, unlike the majority of plastic materials, which come out of the mould with a rough surface, necessitating costly finishing, as in the case of ebonite. It is an excellent insulator, sheets of 0.34 millimetre (1-75th inch) successfully withstanding 5000 volts. A cylindrical block, two-fifths of an inch in diameter and 1 inch long, showed, after immersion for twenty-four hours in warm water, and while still damp, a resistance of 290 megohms. When it dried thoroughly its resistance rose to over 1000 megohms. It is very important, in the manufacture of electrical material, to employ only those insulating materials that can resist the actions of the atmosphere and humidity, otherwise it might happen that substances having absorbed water would be burst by freezing. It is this capital defect that has retired several promising insulating materials from the field of overhead railway material, etc. Ambroine seems to resist sudden variations of temperature and chemical action equally well. Neither sulphuric acid nor hydrochloric acid affects it. This property permits its use for cells for accumulators. Its tensile strength is very high, amounting to over 2800 pounds per square inch. The factory at Ivry sur Seine is very completely equipped. The press and furnace house contains nine hydraulic presses, twelve more being contemplated in the plan. There are fourteen furnaces at work, out of a total of twenty-four to be installed. The steel moulds are made on the premises, and heavy mixing machines are employed to blend the various ingredients. Electric power is used throughout, current being taken from the local electric light company. Twelve motors of various powers, made by the Maison Jacquet frères, of Vernon, are used. The French Ambroine Company is to be congratulated upon establishing a new industry in France, and giving our engineers a new and useful material.

General News.

NEW INCORPORATIONS.

THE WASECA TELEPHONE COMPANY, Waseca, Minn., has been incorporated with a capital stock of $10,000.

THE EUREKA TELEPHONE COMPANY, Eureka, S. Dak., has been formed with F. W. Moettcher, C. N. Herreid, E. G. Kennedy, William Poehler and James Guhin, as incorporators.

THE BRIDGETON TELEPHONE COMPANY, of Bridgeton, N. J., has been incorporated, with a capital stock of $20,000. The incorporators are: Charles and Thomas Esibill, and others, of Vineland, N. J.

THE LAWRENCEVILLE LIGHT & WATER COMPANY, Lawrenceville, Ill., has been incorporated with a capital stock of $25,000. The incorporators are M. L. Lispscomb, F. C. Spring and G. E. Engstrom.

THE HIGHTSTOWN ELECTRIC LIGHT & POWER COMPANY, Hightstown, N. J., has been organized. The incorporators are Francis C. Thorn, Charles P. Fitch and Theo. M. Mostard. Capital stock, $25,000.

THE AURORA ARC LAMP MANUFACTURING COMPANY, Pittsburg, Pa., has been organized with a capital stock of $1,000. The incorporators are Conrad Weber, Frederick Clusman, William Isensec, A. Schohn and George Schlinder.

THE MONONGAHELA VALLEY ELECTRIC COMPANY, of Speers Borough, Washington County, Pa., has been incorporated. Among those interested are Henry F. Gilg, Ernest W. Beach, Robert T. Rossell, Winfield B. Carson and George B. Motheral.

THE DELAWARE VALLEY RAILROAD COMPANY, Delhi, N. Y., has been incorporated with a capital stock of $150,000, for the purpose of operating an electric railway from Delhi to Bovinia Centre. The directors are Henry Davie, J. R. Honehill, Delhi, N. Y.

THE CITIZENS' LIGHT & POWER COMPANY has been organized at Downingtown, Pa., with a capital stock of $10,000. It is the intention of the company to erect a large electric light and power plant along the Brandywine in East Downingtown, and buy out the corporation now in existence. The ultimate intention, it is said, is to build an electric railway from Downingtown to East Downingtown.

THE METROPOLITAN ELECTRIC CONSTRUCTION COMPANY, of New York City, was incorporated at Albany, N. Y., with a capital stock of $50,000 for the purpose of equipping electric railroads, elevators, and dealing in electrical apparatus. The directors are Albert B. Chandler and Edward C. Platt, of Brooklyn; E. H. Johnson, of New York, and W. D. MacQuesten and H. V. Jennings, of Mount Vernon.

THE HUGUENOT ELECTRIC STREET RAILWAY COMPANY of Westchester County, N. Y., has been incorporated. The road will be 11 miles in length, and its termini will be in the village of New Rochelle. It is proposed to make a circuit through the back country, and to return to the village railway station. The capital stock of the company is $110,000, and the directors for the first year are: Louis K. Fries, Jacob M. Schuyler, James H. Burchell, of New Rochelle; George G. Duy, of New York City; Frank E. Wiggins, of Williamsbridge, and A. B. Linderman, John A. Cass and M. B. Faulkner, of Philadelphia.

THE TELEGRAPH AND TELEPHONE.

YPSILANTI, MICH.—It is stated that the new State Telephone Company has now in operation in this city 168 instruments.

PORTLAND, ORE.—The Canyon City Telephone Company has completed a metallic circuit between Baker City and Canyon City.

FREDERICK, MD.—The Inter-State Telephone Company is setting up a new and semi-automatic switchboard, and moving its exchange.

WEST POINT, FAYETTE CO., TEX.—The Southwestern Telegraph & Telephone Company is building a new line between West Point and Lagrange.

ITHACA, MICH.—The Gratiot Telephone Company will likely be consolidated with the National Telephone Company, formerly the Crowley Telephone Company.

WINNEBAGO CITY, MINN.—The Northwestern Long Distance Telephone Company has completed its line to this place, and has opened an office for business. The new company gives connection with St. Paul and Minneapolis.

LINCOLN, ILL.—A company has been organized to build a telephone line from Springfield to Peoria. Thirty miles of lines will be built at once. The line will connect all points in Logan County, also Adams, Petersburg and Mason City.

NEW ORLEANS, LA.—A company with a capital of $500,000 has been organized to build a telephone system in this city. The capital comes from the North, but the enterprise indicates that influential Northerners have confidence in the future prosperity of New Orlenas. Mr. W. P. Curtis is general manager of the new company.

CHESTER, PA.—It is reported that the Delaware & Atlantic Telegraph & Telephone Company has decided to reduce its rates. The present rates are $66 a year, and it is stated that $36 will be the new charge for instruments. It is supposed that the reduction is the result of the presence in the community of the Delaware County Telephone Company.

FORT SMITH, ARK.—The plant of the Arkansas Telephone Company was sold at auction a few days ago for $6,600. Obligations amounting to about $20,000 were assumed by the buyer, who was James Brizzolara. Mr. Brizzolara represented Mr. J. E. Ingalls, of Chicago, who, it is said, is one of the largest stockholders in the Harrison International Telephone Company. No change will be made in the Arkansas Company's management.

DETROIT, MICH.—At a meeting of the directors of the Detroit Telephone Company it was decided to buy $30,000 worth of cable and wire, to extend the plant of the company. It is said that the company will soon have 7,000 telephone connections in its exchange. Mr. Frank Vernor has resigned as secretary of the company, and his place was filled by the appointment of Mr. E. H. Parker, who will act in the dual capacity of secretary and treasurer.

WILMINGTON, DEL.—The Delmarvia Telephone Company opened an exchange in this city recently. Several invited guests inspected the exchange, and were entertained by the president, Colonel McCorkle, Calvin I. Swain and Henry Baird, directors of the company, and Captain Wood, superintendent. Brief speeches were made by H. V. Smith, secretary of the Delaware County Telegraph & Telephone Company, and by Colonel McCorkle, and the progress of the Independent Telephone Association of America was outlined very thoroughly by Mr. H. C. Young, vice-president of that association.

ELECTRIC LIGHT AND POWER.

ORLANDO, FLA.—B. C. Abernethy and others have asked for a charter for an electric light plant.

KNOXVILLE, TENN.—The Knoxville Electric Light & Power Company will make extensive improvements to its power house.

ALBANY, N. Y.—It has been decided to request the Common Council to appropriate $23,000 to make improvements in the electric light station at Watervliet.

EGG HARBOR CITY, N. J.—City Council has granted a franchise to Thomas T. Mather, of Philadelphia, to erect an electric light plant in Egg Harbor City.

FORREST CITY, TENN.—Messrs. T. H. Shepard and M. W. Ewell, of Dyersburg, Tenn., have purchased the city electric light plant, and will at once enlarge it.

ALEXANDRIA, IND.—For some time the City Council has been considering the advisability of buying the electric light plant which is supplying the city's lights.

KNOXVILLE, TENN.—The Knoxville Electric Light & Power Company has filed a mortgage for $100,000. On this bonds will be issued and the money used for extensive improvements.

SCHOOLCRAFT, MICH.—The Schoolcraft Village Council, at the request of taxpayers, will submit to a vote at a special election a proposition to bond the village for water works and electric lights.

SHIPPENSBURG, PA.—The Shippensburg Electric Light Company has been reorganized, and the following-named gentlemen have been elected officers: J. L. Barner, president; W. J. Coffey, treasurer; James Fleming, secretary.

BOULDER, COL.—At the annual meeting of the Boulder Electric Light Company, officers were elected for the ensuing year as follows: President, G. A. McClure; vice-president, H. O. Dodge; secretary and treasurer, J. H. Nicholson.

The Electric Railway.

WESTCHESTER, PA.—The trolley line will be extended from Pottstown and Philadelphia to this city.

WARREN, MASS.—The franchise for the Warren-Brimfield Electric Railway has been granted by the Warren Selectmen.

LEBANON, PA.—The electric road from Lebanon to High Bridge, N. J., by way of Clinton, now appears to be an assured fact.

SOUTHINGTON, CONN.—The Meriden, Southington & Compounce Tramway Company has petitioned the Selectmen for a franchise.

WATERFORD, N. Y.—The Board of Trustees have given permission to connect this village with Mechanicsville and Stillwater, by means of an electric road.

UNIONTOWN, PA.—An electric railroad is to be built through Green County. Pittsburg, Allegheny and Wheeling capitalists are interested.

MERIDEN, CONN.—It is proposed to build a new trolley line from this place to Southington. Messrs. Atwater and Hurley, of Meriden, are interested.

GREENSBURG, PA.—The stockholders of the Greensburg, Jeannette & Pittsburg Electric Railway have decided to extend their road to Irwin in the spring.

PERTH AMBOY, N. J.—Representatives of the Rahway & Sewaren Electric Railway Company have petitioned the Board of Aldermen for right of way.

COLLINGSWOOD, N. J.—The Council has granted the Camden & Suburban Railroad Company right of way, and the line will be extended to Haddonfield.

GERMANTOWN, PA.—The Chelton Avenue & Twenty-second Street and Allegheny Avenue Passenger Railways have petitioned councils for permission to extend their lines.

MILWAUKEE, WIS.—The Milwaukee Electric Railway & Light Company is about to expend $300,000 in equipping new lines and in making extensions to the present system.

Personal Notes.

HERR VON HEFFNER-ALTENECK, of Berlin, has been awarded an honorary degree of Doctor of Philosophy by the University of Munich in recognition of his services to the study of electricity.

MR. MINOR M. DAVIS, assistant electrical engineer of the Postal Telegraph-Cable Company, has been appointed to the position of general traffic manager. Mr. Davis will have charge of the assignment of circuits and of the traffic. His headquarters will continue to be in New York.

MR. SYLVESTER A. COSGRAVE, JR., who was formerly connected with the Westinghouse Electric & Manufacturing Company, at Pittsburg, is now a traveling representative of the Sawyer-Man Electric Company, of Allegheny City, Pa. Mr. Cosgrave's bailiwick embraces the territory of Western Pennsylvania, Ohio and West Virginia, and he has been very successful in his new field of activity.

MR. SAMUEL INSULL, president of the Chicago Edison Company, was entertained at a dinner given by several gentlemen interested in electrical undertakings, in England, at the Whitehall Club, London, on January 6. Among those present to do honor to the guest of the evening were Messrs. Philip Dawson, Sidney Dobson, R. E. Crompton, S. Z. de Ferranti, H. F. Parshall and P. R. Sellon. Mr. Insull described the up-to-date American practice in the electricity supply business, and gave a brief outline of the system of his own company. Remarks were made by Messrs. Crompton, Ferranti and others. The dinner was entirely informal, and an exceedingly pleasant one. Our contemporary, *Lightning*, of January 13, gives an interesting account of the event.

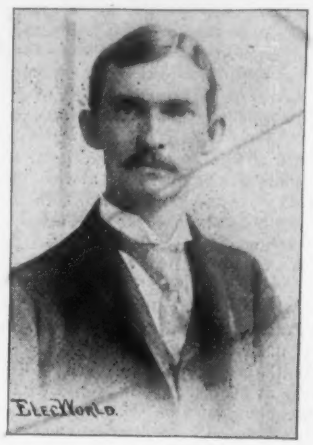
Legal Notes.

JUDGE WHEELER, of the United States Circuit Court, has handed down a decision sustaining the validity of the electric railway motor suspension patent controlled by the General Electric and Westinghouse Companies and ordering an injunction against both the Walker Company and the Union Railway Company, of this city, better known as the "Huckleberry Road," restraining their use of it. This motor suspension apparatus is the standard one, embodying the principle of suporting the motor on an arm in such a manner that it may oscillate without changing its distance from the main wheel axle.

JUDGE COOLIDGE has filed an opinion in the injunction cases of the Michigan Bell Telephone Company *vs.* the cities of Benton Harbor and St. Joseph, Mich. The telephone company asked the court for an injunction restraining the two cities from removing any of its poles or in any way interfering with the work of constructing its lines. In his decision Judge Coolidge refuses to grant an injunction against Benton Harbor. Benton Harbor never entered into any contract relations with the telephone company, and in consequence the city is not estopped by reason of any sanction given to the use of its streets by the complaining company. In the St. Joseph case, Judge Coolidge gives that city until January 31 to answer the petition of the complaining company by providing by ordinance, resolution or instruction to the proper officers, regulations by which the telephone company may extend its lines. The municipality, Judge Coolidge says, has a right to prohibit the placing of poles in its streets whenever this would be dangerous to public safety, but has no right to regulate or control rates which a private person or corporation shall charge its private patrons, unless the power to do so is expressly authorized by the constitution or legislative provision. Several cities in the State are awaiting the outcome of these suits with much interest.

Obituary Note.

MR. O. B. SHALLENBERGER, inventor of the Shallenberger meter, and many other well-known electrical devices, and for a long time one of the engineers of the Westinghouse Electric & Manufacturing Company, died at Col-



O. B. Shallenberger.

orado Springs, Col., on Sunday, January 23. Mr. Shallenberger had been ill for some time, but it was not thought that his death was imminent. The funeral will take place on Sunday, January 30, at Rochester, Pa.

Trade and Industrial Notes.

MR. JOHN E. HALL, Colchester, Ill., is in the market for telephones and supplies for a telephone exchange. He desires to receive circulars and prices on appliances.

MESSRS. ZIMDARS & HUNT, 127 Fifth Avenue, New York, in their catalogue "C," just issued, describe and illustrate their line of automatic switches and motor starters.

A NICKEL-PLATING PLANT WANTED.—Mr. T. L. Hickman, manufacturer of surgical instruments, 80 Baker Street, Fort Wayne, Ind., is in the market for a nickel-plating plant.

THE AMERICAN BATTERY COMPANY, Chicago, Ill., informs us that its factory, at 42 West Quincy Street, has been destroyed by fire. The office and new works are at 174 South Clinton Street.

THE LYNN INCANDESCENT LAMP COMPANY has just issued a price list of its "new Lynn incandescent lamps." In addition to repairing old lamps, the company has put upon the market a new lamp of its own make.

MESSRS. THORPE, PLATT & CO., New York City, inform us that the high-pressure fittings and flanges described in a booklet referred to in our last issue, are made by the "Tight Joint Company," and not by themselves.

THE CENTRAL ELECTRIC COMPANY, Chicago, reports that the Brunt regulating socket for incandescent lamps is meeting with a ready sale, and it further states that these goods are among the best articles of the kind yet produced.

THE DIRECTORS OF THE KEYSTONE ELECTRIC COMPANY, Erie, Pa., at their recent meeting elected the following named officers: President, Hon. J. F. Downing; vice-president, F. B. Downing; secretary and treasurer, J. W. Leech.

MR. FRED. J. CROSS has severed his connection with the Buffalo Engine Works as manager of its electrical department, and has opened an office at 310 Mooney & Brisbane Building, Buffalo, N. Y. Mr. Cross will conduct a consulting electrical engineering business.

THE UTICA ELECTRICAL MANUFACTURING & SUPPLY COMPANY, Utica, N. Y., held its annual meeting recently and elected the following named officers: President, William E. Lewis; vice-president, W. H. Cloher, Jr.; secretary and treasurer, M. Jesse Brayton.

THE SAFETY INSULATED WIRE & CABLE COMPANY, through Mr. E. J. Spencer, its St. Louis agent, has closed a contract for all the conductors, inside wire, cable and underground cable for lighting and power, at the Trans-Mississippi & International Exposition, at Omaha, Neb.

THE WHEELER ELECTRIC & MANUFACTURING COMPANY, Dayton, Tenn., has just issued a little pamphlet descriptive and illustrative of the Wheeler mechanical electrical dental engine. The engine is wound for battery, 110-volt direct, or 52 or 104-volt alternating current.

THE INTERNATIONAL CORRESPONDENCE SCHOOLS, Scranton, Pa., has issued a pamphlet containing the indorsements of ninety-six of its students of its electrical engineering courses. They all speak highly of the work done by the schools and of the method of instruction.

THE WARREN ELECTRIC & SPECIALTY COMPANY, Warren, Ohio, informs us that it has made large extensions to its plant, both in buildings and machinery, in order to better care for the increasing trade which it is experiencing. It is vigorously pushing its independent lamp. At the annual meeting of the stockholders, recently held, directors were elected. These elected the following named gentlemen as officers for the ensuing year: T. H. Gillmer, president; E. W. Gillmer, secretary and treasurer; C. H. Angstadt, vice-president.

MESSRS. HUEBEL & MANGER, Brooklyn, N. Y., are proud of their reputation as manufacturers of ringing bells. The home and foreign trade, they say, appreciates the excellence of their bells, both as to service and price, and where a satisfactory bell is wanted theirs supplies the call every time.

MR. JOSEPH BURKART informs us that he has sold out his interest in tht firm of Burkart & Widmayer, New York City, and opened an office at 1123 Broadway, where he is prepared to execute all kinds of electrical work, such as electric light wiring, bells, burglar alarms, gas lighting, motors, dynamos, etc.

A LARGE FOUNDRY FOR THE GENERAL ELECTRIC COMPANY.—A Schenectady dispatch states that the General Electric Company is preparing plans for one of the largest iron foundries ever constructed in this country. It will be 500 feet long and 130 feet wide, and will be erected in Schenectady.

THE CUTTER ELECTRICAL & MANUFACTURING COMPANY, Philadelphia, Pa., has just issued a new catalogue and price list of its I. T. E. circuit breakers—single-pole, double-pole, double-pole double-coil and triple-pole instruments being listed. A copy of this circular may be had on application at the company's home office, or its New York office.

THE WESTERN ELECTRIC COMPANY'S 12-inch desk fan for 1898, it is said, consumes less current than is used by a 16-cp incandescent lamp. The company will soon issue a thirty-two page fan motor catalogue listing direct and alternating-current fan motors, also battery fan motors. Those interested in fan motors will do well to write for a copy of this catalogue.

THE A. A. GRIFFING IRON COMPANY, 66-68 Centre Street, New York City, informs us that it has received from the American Institute Fair, which was held at Madison Square Garden last fall, medals on the following named goods: Bundy heaters and radiators, steam traps, gravity pumps, feed water heaters, steam and oil separators, exhaust heads and low water alarm.

MESSRS. A. L. FENTON & CO., 39-41 Cortlandt Street, New York City, have just issued a circular to the trade calling attention to the Eureka anti-friction metal, for which the firm is the selling agent. Eureka anti-friction metal is guaranteed to be strictly first-class, and especially adapted for high speed and heavy engines, dynamos, railroads, mills, etc., where an anti-friction metal is required.

THE FERRACUTE MACHINE COMPANY, Bridgeton, N. J., has just issued a large sheet illustrating a long line of foot and power presses. These presses are adapted for a wide range of work, including the manufacture of electrical goods, and anyone interested in this class of machinery can obtain further information regarding the same by writing to the company for a copy of its illustrated catalogue.

THE JOHN A. ROEBLING'S SONS COMPANY, New York, has just issued a neat little pamphlet on its Climax resistance wire. This wire has high specific resistance, and is said to possess etrength and toughness far in excess of ordinary wires used for resistance work. It has nearly fifty times the resistance of copper. Tables are given showing its resistance at given temperatures above 75° F.; its carrying capacity, and its properties.

THE ELECTRIC APPLIANCE COMPANY, Chicago, will be glad to send a copy of its latest circular to any applicant for the same, on the subject of the Upton Midget long-burning arc lamp, which has become quite popular. This lamp is one of the company's specialties. Its small size, light weight and neat appearance make it very desirable for inside use, while its positive and steady action and general reliability are features which are extending its popularity.

MR. H. B. CROUSE, of the Crouse-Hinds Electric Company, Syracuse, N. Y., was in New York last week, perfecting arrangements for the removal of the company's New York office from 39 Cortlandt Street to the Havemeyer Building. The removal is rendered necessary on account of the increasing demand for the Crouse-Hinds and Pass & Seymour specialties, and this change will enable Mr. F. M. Hawkins, the Greater New York agent, to carry a much larger stock of goods.

THE WARD LEONARD ELECTRIC COMPANY, Bronxville, N. Y., reports a most pronounced increase in the demand for rheostats since the beginning of this year, both in this country and abroad. It states that nearly all of the leading manufacturers abroad use its rheostats. This apparatus is one of the few kinds that the foreign engineers seem to prefer to their own product. No doubt the many commercial difficulties incidental to the manufacture of the enamel rheostat accounts for this.

THE BARAGWANATH CONDENSER is the subject of a pamphlet issued by William Baragwanath & Son, 48-52 West Division Street, Chicago. This condenser is applicable to any purpose for which a vacuum is required, and is set at a height of 34 feet above the hot well, which height is sufficient to clear the condenser of its discharge of water and air by gravity alone. Various applications of the apparatus are illustrated, and indicator cards taken from engines show the economy to be attained by the use of this condenser in steam plants.

THE HOPPES MANUFACTURING COMPANY, Springfield, Ohio, has recently received several large orders through its Philadelphia office. These include contracts as follows: The New York Sugar Refining Company, Long Island City, N. Y., three special live steam feed water purifiers, aggregating 3750 horse power, also three exhaust steam feed water heaters of 4500-hp capacity for the same company; the Union Traction Company, Philadelphia, Pa., 3000-hp special live steam feed water purifiers for high pressure. Through the Springfield office sales are reported as follows: to the Deering Harvester Company, Chicago, 2500-hp live-steam feed water purifiers; a repeat order from the Proctor & Gamble Company, Ivorydale, Ohio., for 1000-hp purifier, and several others.

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia, has just issued a catalogue of its chloride accumulators. The advantages of storage batteries in central stations for power plants and regulation are very fully set forth, and illustrations are given of plants of this character. Chloride accumulators in office buildings and in large and small isolated plants are also very comprehensively considered. The advantageous use of accumulators for street car traction is discussed, and several references of roads on which storage batteries are used are cited. A great deal of valuable information concerning the various types of chloride accumulators is given in tabular form, and at the back there are some instructions for setting up and using chloride accumulators.

A NEW STYLE OF WAGNER TRANSFORMER.—The Wagner Electric Manufacturing Company, St. Louis, Mo., has brought out a new style of transformer which is styled the "Type F." It is quite similar to the "Type G" transformers recently mentioned in these columns, which are designed for the very highest economy in all-day average lighting service, with an average price of coal, and consistent with the first cost of the transformer. Naturally, in plants with a lower cost of generating power, as hydraulic installations, or plants using cheap coal, it does not pay to expend as much for high economy as on systems where power is more expensive. The same applies to plants giving only a night service instead of an all-day service. For such systems the new "Type F" transformer is designed. Its relative economy is slightly less than that of "Type G," being on what is called typical all-day service, namely, four hours full load and twenty hours no load, from 1 to 3 per cent. less. Otherwise, it embodies many of the mechanical and other improvements of the new "Type G," and is intended to replace what was formerly put out as "Type D."

A GOOD BUSINESS IN ENGINES.—Among recent shipments of engines by the Ridgway Dynamo & Engine Company, Ridgway, Pa.; were: One 90-hp tandem compound engine to the Deadwood & Delaware Smelting Company, Deadwood, S. Dak.; one 125-hp simple engine to the Logan Consolidated Coal Company, Mattewan, W. Va.; one tandem compound engine, direct-connected to one 100-kw generator, to the United States Iron & Tin Plate Manufacturing Company, Demmler, Pa.; one 200-hp simple engine to Newsam Brothers, Kingston Mines, Ill.; one 175-hp simple engine to the Lackawanna Light, Heat & Power Company, Taylor, Pa.; and one 50-kw belted generator to the city of Macomb, Ohio. Orders for engines yet unfilled: One 50-hp simple engine to the Waterous Engine Works Company, Limited, Brantford, Canada; two tandem compound engines, direct-connected to two 150-kw generators, to the Bucks County Railway Company, Doylestown, Pa.; one 250-hp simple engine and one 150-kw belted generator to the Berwind-White Coal Mining Company, Scalp Level, Pa.; one simple engine, direct-connected to 20-kw generator, to the Schussler Brewing Company, Buffalo, N. Y.; one 35-hp simple engine to the Model Mill Company, Nashville, Tenn.; one 200-hp simple engine to the Phillipi Coal Mining Company, Phillipi, W. Va.; one 125-hp simple engine to the Eldon Coal & Mining Company, Ottumwa, Ill.; one 150-hp tandem compound engine to the State of Arizona Improvement Company, Yuma, Ariz.; one 100-hp engine to the Ohio & Mississippi Coal Mining Company, Marion, Ill.; one 25-kw belted generator, Fessenden Manufacturing Company, Pittsburg; and one 40-kw belted generator for the DuBois Iron Works, DuBois, Pa.

Business Notice.

A FINE VIEW OF PIKE'S PEAK and of Mounts Harvard, Yale and Princeton in the Rocky Mountains can be had from the tourist car of the Midland Tourist Route, which leaves Chicago for California at 10 o'clock every Saturday night from the Chicago, Milwaukee & St. Paul Railway passenger station. For illustrative descriptive circular apply to the nearest coupon ticket agent, or address E. F. Richardson, General Agent Passenger Department, C., M. & St. P. Ry., 381 Broadway, New York City.

Illustrated Record of Electrical Patents

UNITED STATES PATENTS ISSUED JANUARY 18, 1898.

[In charge of Wm. A. Rosenbaum, 177 Times Building, New York.]

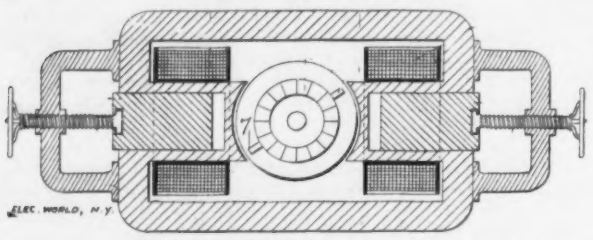
597,418. REGULATION OF DYNAMO ELECTRIC MACHINERY; F. A. Johnston, Binghamton, N. Y. App. filed April 14, 1897. The method of producing and varying the magnetic flux in a dynamo-electric machine, which consists in creating a magnetomotive force in a magnetic circuit, composed at one or more points of several branches, generating in one or more of said branches a second magnetomotive force, and varying said second magnetomotive force at will to vary the total flux through the machine, while maintaining a strong flux through those branches of the magnetic circuit which furnish the field for the coils under commutation.

597,419. REGULATION OF DYNAMO ELECTRIC MACHINERY; F. A. Johnston, Binghamton, N. Y. App. filed April 24, 1897. The method of varying the speed of an electric motor, which consists in generating a flux passing through the coils under commutation by a practically constant magnetomotive force, and generating a second flux passing through other coils of the armature, by an independent magnetomotive force, and varying said second flux at will, independent of the conditions of the main circuit.

597,424. ELECTRIC ARC LAMP; A. Mougin, Paris, France. App. filed Feb. 13, 1897. In an electric arc lamp, a motor interposed in the circuit of derivation, and comprising an uneven number of bobbins, each having the wire coiled thereon, connected at one end with the lamp, and at the other end with a segment of the collector, said collector comprising a number of insulated segments against which the brushes rub, and which are equal in number to the bobbins; the current of derivation entering the motor through the brushes and going out through the lamp.

597,432. ELECTRIC CAR BRAKE; C. F. De Redon, New York, N. Y. App. filed Sept. 22, 1896. In a railway brake, a magnet carried by the car, and at each side of the latter, combined with a pivoted brake arm carried from the end of each magnet and turning inward in line with the length of the magnet, and a brake shoe for contact with the rail carried by each of said brake arms.

597,433. ELECTROMAGNETIC RAILWAY CAR BRAKE; C. F. De Roden, New York, N. Y. App. filed April 22, 1897, In a railway car brake, an electromagnet at each side of the car, and the arm or pole pieces extending downward from one end of said magnet, combined with the brake arm pivoted to the lower end of said pole piece, and extending at substantially right angles therefrom, and the shoe carried by and being substantially in alignment with said brake arm, said brake arm having intermediate at its ends the joint to prevent the jarring motion of the car from affecting the relation of the brake shoe to the rail.



No. 597,418.—Regulation of Dynamo Electric Machinery.

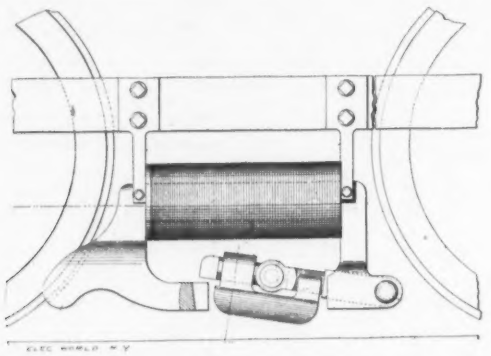
597,467. TROLLEY CAR; J. D. Hull, New York, N. Y. App. filed Feb. 1, 1897. An attachment for controlling and manipulating the pole of a trolley car, which consists of a support provided with a circular head, and adapted to be secured to either end of the car, a shaft passing centrally through said head, a revoluble disc mounted on said shaft adjacent to said head, a spool mounted on said shaft adjacent to said disc, a spring mounted at each side of said disc, one end of one of said springs being secured to said spool and the other to said disc, and one end of the other spring being secured to said disc, and the other to said head, and a locking device for locking the disc to the head, so as to prevent the revolution thereof, and devices connected with the spool for releasing said locking devices and operatively engaging said disc.

597,470. RHEOSTAT; M. Norden, New York, N. Y. App. filed April 22, 1897. The combination with two or more rheostats, having contacts in arcs of circles, of arms and concentric shafts carrying such arms, a switchboard through which the concentric shafts pass, and hand wheels upon the outer ends of the shafts for adjusting the contact arms.

597,492. FILAMENT FOR INCANDESCENT LAMPS; F. E. W. Bowen, London, England. App. filed Aug. 17, 1897. An improved filament for incandescent lamps, in the body of which is incorporated the borate of a refractory metal.

597,508. CONDUIT FOR ELECTRIC RAILWAYS; C. V. Osborn, Dayton, Ohio. App. filed July 18, 1896. A sub-surface conduit for carrying electric conductors for railways use, consisting of two side walls bolted together, brackets limiting the width of the conduit and supporting surface plates.

597,516. ELECTRIC TROLLEY DEVICE; G. Valley, Johnstown, Pa. App. filed March 8, 1897. A trolley, comprising a suitable base portion, and a tilting standard pivoted thereto and upheld by yielding members, in combination with a pair of arms pivoted to said standard, a second pair of arms pivoted to the base portion, a contact carrying arm pivoted to the upper



No. 597,433.—Electromagnetic Railway Car Brake.

ends of both of said pairs of arms, and compression springs secured between said pairs of arms and adapted to impart upward pressure to the contact carrying arm.

597,532. REFRIGERATING APPARATUS; W. F. Singer, New York, N. Y. App. filed April 5, 1897. In a refrigerating apparatus, the combination with the gas pumps, the rotor of an electromagnetic motor geared thereto, a hermetically sealed casing inclosing the same, and the gas return pipe from the expansion coil leading into the casing, of a field magnet or stator exterior to the portion of the casing which incloses the rotor.

597,536. SIGNAL TELEGRAPH; C. V. Boughton, Buffalo, N. Y. App. filed Dec. 19, 1895. In a signal telegraph, the combination with a flexible light shaft, having incandescent lamps thereon, separate feed wires for such lamps, and a common return wire, all passing through the shaft; of a coupling carrying wires adapted for connection with those in the shaft, devices in the coupling for making such connection automatically, and a yoke pivoted to one member of the coupling and engaging the other when the members are assembled.

597,587. TELEGRAPHIC SIGNAL; J. Nicolson, Buenos Ayres, Argentina. App. filed Feb. 26, 1897. Telegraph signals, having an uneven number of elementary motions for the vowels and accented vowels of the alphabet, and an even number of such motions for the consonants of the alphabet.

597,601. ELECTRIC ARC LAMP; E. Blaser, California, Mo. App. filed July 15, 1897. The combination of a support, a frame mounted to swing vertically therein, a carbon carrier movable vertically and independently of the frame, mechanism operatively connecting the carrier and frame, a brake lever fulcrumed to the support for controlling said mechanism, a connection between the lever and frame for holding the former inoperative while the frame is lowered, and frame actuating mechanism.

597,642. ELECTRIC SWITCH; E. M. French, Stoughton, Mass. App. filed Sept. 16, 1897. In an electric switch, the combination with a suitable base, of opposite sets of electromagnets included in a local battery circuit, comprising a pair of push buttons, each set of electromagnets having an armature independent from that of the other, a pivoted switch lever between and at a distance from said electromagnets coacting with a conducting contact, and a main line circuit including illuminating devices connected to the said pivoted switch lever and the conducting contact, and a cord extending in opposite directions from the end of the switch lever farthest from the conducting contact and attachment to the free ends of the opposite armatures, whereby the illuminating devices in the main line circuit may be controlled by the push buttons in the local battery circuit for illuminating and extinguishing purposes without carrying the heavy main line wires into a building.

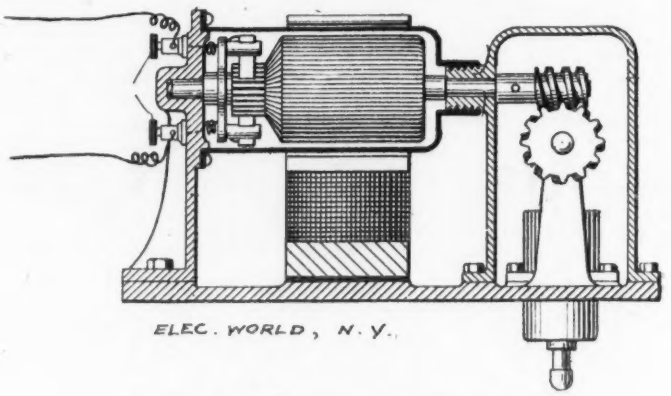
597,646. MACHINE FOR ASSORTING CARBONS; H. S. Hart, Chicago, Ill. App. filed Aug. 2, 1897. In a machine for assorting carbons, a table and means for rolling the carbons over the table, in combination with devices for gauging the imperfections of the carbons and ejectors controlled by said gauging devices.

597,650. ELECTRIC LOCK AND SYSTEM OF ELECTRICAL LOCKING FOR SECURING ADDITIONAL SAFETY IN RAILROAD SIGNALING; J. F. W. Morris and G. Mumford, London, England. App. filed Oct. 16, 1896. In a locking apparatus for use on railways, the combination of an operating lever and a locking bar in operative connection therewith, blocks provided with locking surfaces, a tumbler provided between the blocks, and engaging the said locking bar, with a block for engaging the tumbler and locking surfaces, the said block having a movable bearing and an electromagnet to release the block from the tumbler and locking surfaces.

597,689. KEYBOARD TELEGRAPHIC TRANSMITTER; S. Price, Paterson, N. J. App. filed June 17, 1897. A keyboard transmitter, provided with means for transmitting electrical impulses in the nature of a Morse code over a telegraph line, in combination with propelling mechanism therefor adapted to enable the operator to store up the prepared record in advance of its transmission and at any desired speed, together with additional propelling mechanism for causing the transmitted impulses to be sent at a substantially constant speed.

597,693. TROLLEY WHEEL; H. B. Sawyer, Chicago, Ill. App. filed June 19, 1897. A removable bracket for trolley poles, consisting of arms secured to a socket, in combination with a sleeve designed to be attached to the trolley pole, and having upon its upper end an annular collar, and having secured near its lower end an adjustable collar, in combination with a withdrawable spring controlled stop pin.

597,700. CIRCUIT BREAKER; F. C. Robertson, Toronto, Canada. App. filed July 22, 1895. A circuit breaker or line opener, consisting of a fusible



No. 597,532.—Refrigerating Apparatus.

wire, a subsidiary circuit to earth and a relay magnet interposed in the circuit between the line wire and the protected instruments, the relay magnets consisting of a magnet frame, a magnet core attached to the magnet frame, a magnet winding on the core, a circuit with the line wire and protected instruments, an armature pivotally connected to the magnet frame, an insulated contact point connected to the magnet core, tapping the magnet winding, the armature so adjusted that under the normal condition of the current it will be unattracted, but on an abnormal current attempting to circuit through the relay magnet it will be attracted and will impinge on the insulated contact point and close the subsidiary circuit to earth, a spring for normally keeping the armature from the magnet core, a back stop to limit the opening movement of the armature, a lightning arrester interposed between the fusible wire and relay magnet, consisting of a clip and a sheet of mica supported by the clip.